Systems Analysis
For a "New Generation" of Military Hospitals

Summary

Final Report

Sponsored By Advanced Research Projects Agency, ARPA Order No. 1494

Arthur D. Little, Inc.

SYSTEMS ANALYSIS
FOR A "NEW GENERATION" OF MILITARY HOSPITALS

SUMMARY

FINAL REPORT

TO THE ADVANCED RESEARCH PROJECTS AGENCY
OF THE DEPARTMENT OF DEFENSE

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PREFACE

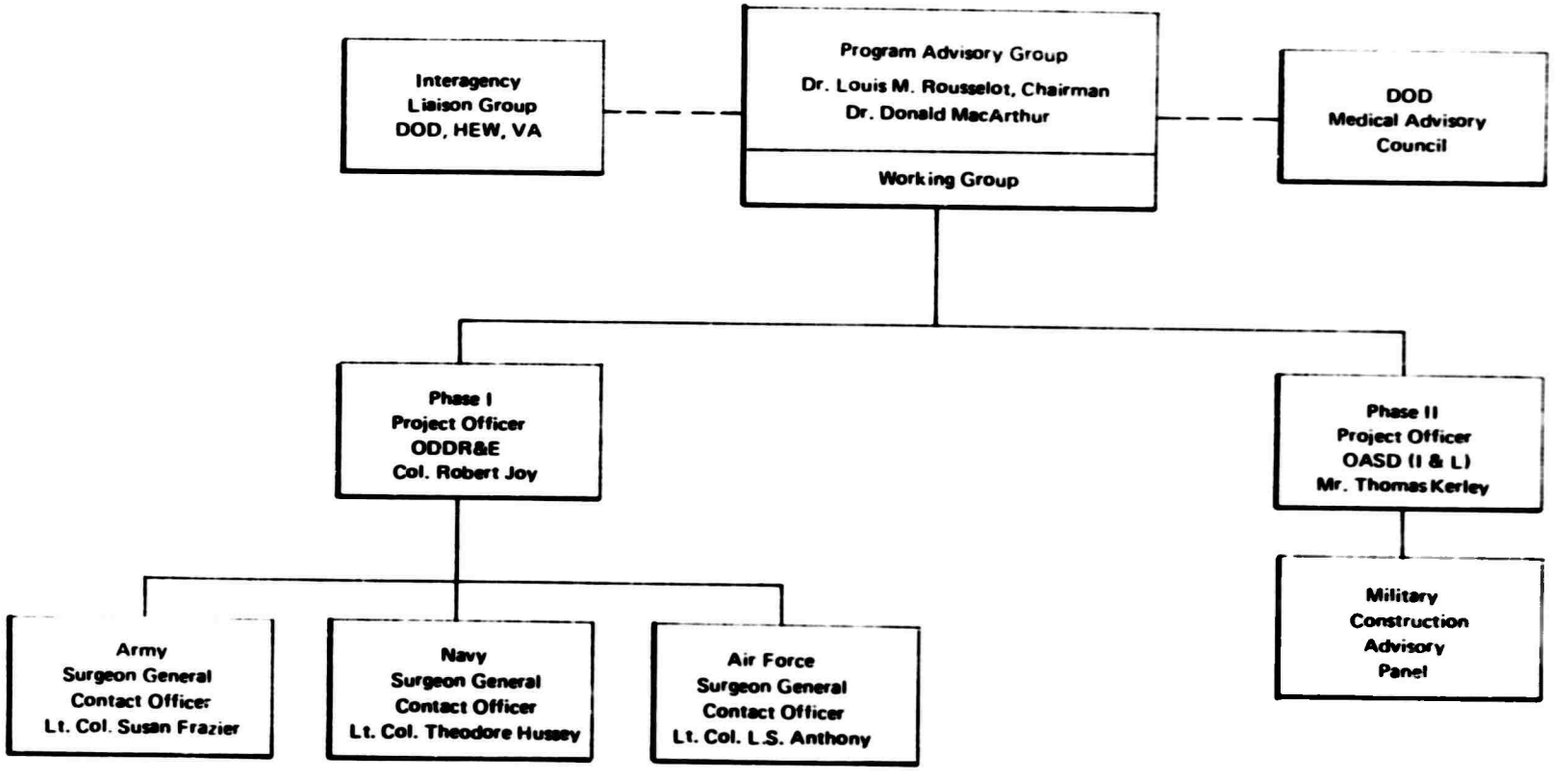
This volume is a summary of the Systems Analysis for a "New Generation" of Military Hospitals completed by Arthur D. Little, Inc., for the Department of Defense. The complete final report consists of nine volumes, whose contents are outlined in Volume 1.

Volume 1	Analysis of Military Health Care
Volume 2	Reorganization of the Base-Level Military Health Care System
Volume 3	Acquisition of Fixed Health Care Facilities
Volume 4	Development of the New Generation
Volume 5	Appendices: Improvements to Provision of Medical Services
Volume 6	Appendices: Improvements to Facilities for Patient Care
Volume 7	Appendices: Improvements to Support Services
Volume 8	Appendix: Survey of Military Hospitals
Volume 9	Appendix: Building Systems in Military Hospitals

This management summary contains in abbreviated form the salient features of the study and the conclusions from the rest of the report. It omits the detailed reasoning and analysis which comprise the full report.

This study synthesizes the work of many people on the staffs of Arthur D. Little, Inc., Lester Gorsline Associates, SRS Consultants, Inc., Campbell, Aldrich and Nulty, Architects, and consultants from various universities and hospitals. In addition, it bears the work of numerous officers in the military services and civilians in the Department of Defense. The study participants from the companies named above must bear responsibility for any errors or omissions, but we gratefully acknowledge the assistance, suggestions, and constructive criticism given us along the way by the members of the Department of Defense.

The Department of Defense set up a special project organization as shown on the following page, under the direction of Dr. Louis M. Rousselot, Assistant Secretary of Defense (Health and Manpower) and Dr. Donald MacArthur, Deputy Director, Defense Research and Engineering. Besides members of DOD, the group included representatives from the Department of Health, Education and Welfare and from the Veterans Administration.



PROJECT ORGANIZATION WITHIN THE DEPARTMENT OF DEFENSE

1. PURPOSE OF THE STUDY

The goal of this study has been to apply the techniques of systems analysis to the problem of designing the health care system for domestic military bases. The central element of this system is the military hospital, from which the study gets its name, "Systems Analysis for a 'New Generation' of Military Hospitals." It is a "new generation," because essentially no constraints were placed upon the study team except that whatever they conceived for the "new generation" had to be feasible, given the mission, the available military personnel, and the military requirements of the services. Thus, we were free to consider changes in patterns or procedures for care, in staffing and training, in organization, in planning and design of the buildings, and in the equipment utilized.

As in every study without external constraints, it was necessary to establish guidelines defining those matters which would be subjects of study.

- In the case of facilities or equipment, the study was to be confined primarily to items located on the base. With regard to organization, procedure, or staffing, it was confined primarily to matters within the authority of the hospital commander or post surgeon to administer, though not necessarily to establish regulations for; thus, we did not consider changes in selective service policy, assignments, lengths of tours, and the like.

- The study was to deal with care of active and retired personnel and their dependents. Thus, we excluded veterinary practice.

- The focus of the study was to be primarily on *how* health care is delivered rather than *what* health care is delivered, particularly when the choices lie outside the hospitals and dispensaries. For example, distributing contraceptives, increasing sanitation measures, or undertaking inoculations could be considered subjects of study, since each potentially affects the cost of care. Whether such things are done, or how intensively they are done, were regarded as policy questions lying outside the scope of our study.

- We were to examine areas where there was more than one reasonable method of approach alternative. Thus, we excluded procedures where, for whatever reason, we could find no feasible alternative. A principal criterion was that

alternatives had to look reasonable in the light of present technology or technology developable within, say, four or five years; accordingly, we excluded conceivable but highly advanced possibilities such as spoken inputs to computers.

- The study was to concentrate on areas where alternative improvements would have a significant impact on costs or care, not trivial matters like stamp machines or baby pictures.

The phrase "subjects of study" was chosen with some care; many factors which fall outside the guidelines affect health care delivery and cannot be ignored, but they were not regarded as subjects of study. Thus, for example, the fact that a great many physicians serve only two years demonstrably creates inefficiency. However, this was not a subject of our study in the sense of evaluating, say, the effect of lengthening tours of duty or raising doctors' pay. At the same time, the fact that many physicians serve only two years could not be disregarded, because it affects many practices.

The product of the study is a set of recommendations, applicable not just to one hospital but the whole generation of hospitals to be built in the 1970's and after. The results are cast in a form which makes clear their presumed merit in different circumstances and the limitations to their applicability.

2. BACKGROUND

The system delineated as a subject of study operates in an "environment" consisting of the activities of the military base, the activities of higher commands, particularly the three Offices of the Surgeons General, and the health care activities of the civilian economy. What goes on outside the base-level health care system has a great deal to do with what goes on within it. For this reason it seemed desirable to set out some speculations about the environment of military health care in the 1970's and 1980's, since this is the background in which the "new generation" of military hospitals will operate.

Health care in the United States is presently undergoing far-reaching changes, and it is by no means clear what all the results will be. Despite uncertainties about specifics, however, certain conclusions are fairly easy to agree upon:

- There will be considerably more use of paramedical personnel. The Department of Defense is in an exceptionally good position to undertake an expanded program for training and using paramedical personnel, adapting the military-base health care system to use them effectively. The shortage of physicians and other medical personnel, which the military will feel especially acutely, makes this necessary. This shortage is widely recognized and the time is right.

- It is essential that structures be adaptable and that operations be self-reviewing and self-renewing. Advances in technology make this evident. This view is only reinforced by speculations about reduction of dependent care or community cooperation.

- More automation will become the norm in medical care. The forces leading to automation are stronger than economic ones. Machines and people are not totally interchangeable, and when machines are superior in reliability, accuracy, or regularity, they are likely to be regarded as preferable. A system which resists automation is likely to be regarded as backward.

These generalizations bore strongly on selection of issues for study and on conclusions reached in the study.

3. METHOD OF ANALYSIS

The basic tool used in evaluating choices in this study was cost-benefit analysis. By this we mean explicitly itemizing all the important considerations which bear on a choice among alternatives. Defining alternatives to present practices in the base-level health care system was the first requirement. These were stated as hypotheses for potential improvements. Some were derived from novel practices in this country and abroad; others were original conceptions, at least in their details. The *hypotheses* dealt with in this study and evaluated in the report are as follows:

- Because many patients in military hospitals are not very sick by civilian standards, savings and other benefits can be gained by building light care facilities in conjunction with acute care facilities.

- To alleviate the shortage of physicians, ambulatory care can be reorganized in a way which makes use of more nonphysicians (corpsmen and nurses with special training) without loss of quality.

- In a similar fashion, specially trained dental assistants can be used more extensively to alleviate the shortage of dentists.

- Clinical laboratory tests can be automated somewhat more than they are now to reduce the cost of making determinations. In the chemistry laboratory it is possible to provide results within a minute or two after a sample is drawn, even at dispensaries remote from the laboratory.

- Automated materials handling systems can produce savings by reducing the manpower required to move materials in a hospital.

- Vacuum trash and linen collection systems can save personnel and are more convenient than present methods.

- Convenience foods are cheaper than meals prepared in the hospital, offer adequate variety, and are quite palatable.

- The costs of linen service can be reduced by using disposable linens.

- Unit packaging and automated dispensing of drugs can save nurses' time, reduce errors in administering drugs, and allow quicker filling of prescriptions.

- Multiphasic testing facilities can reduce the cost of making physical examinations.

- Closed circuit television can be used for remote consultation or remote diagnosis to improve the quality of care and increase convenience to patients.

- The staff of a military hospital can be motivated to be more cost conscious than they are now and thereby reduce operating costs.

- An automated management information system is feasible and can be used to keep track of the operating efficiency of all departments in a hospital, thus providing a real-time measure of performance.

- An automated hospital information system can be installed to process all orders and to record all results and actions.

- Inpatient records can be kept in a computer file and portions retrieved as necessary by the medical and nursing staff to improve the quality of care.

- Computer-controlled patient monitoring systems can be used to reduce the staff required in intensive care units and to reduce morbidity and mortality.

- Computers offer a more reliable and cheaper means for inventory control, scheduling, and certain aids to practice such as diagnosis and psychiatric support.

- Obstetrical services, as an example of a service not required by military needs, can be eliminated from military hospitals and provided through CHAMPUS in order to reduce costs.

- The novel methods of design and construction called building systems can be adopted or adapted to the needs of military hospitals.

- The process by which military hospitals are planned, designed, and built can be speeded up, made more rational, and result in buildings better adapted to the needs of the users through such novel practices as planning units, form diagrams, and multitrack scheduling.

- Layouts of hospitals can be made more rational and efficient by enlisting the aid of a computer to develop and evaluate them.

- There is an economically optimum room size determined by a balance between the efficiency of large rooms and the reduction in problems of mixing patients (e.g., men and women) with small rooms.

In each case our task was to compare present practices with the hypothesized alternative. To make the analysis specific, and therefore realistic, each hypothesis was particularized for each of three military bases: Fort Dix, Jacksonville Naval Air Station, and March Air Force Base. These bases include the three services and span the range of hospital sizes of interest, from 200 beds at March AFB to 900 beds at Fort Dix. In this way we were less likely to overlook impediments and constraints arising from peculiarities of each service or from the size of the base hospital. As the analysis evolved, the specific descriptions of improvements were adapted to requirements of military health care and to each other, so that the final conclusions describe a realistic and mutually supporting set of characteristics for the base-level health care system of the future.

The primary considerations in our evaluations have been relative costs of alternatives, including capital and operating costs (which comprise salaries, maintenance, supplies, and overhead) and, where appropriate, hidden costs such as those for training. Other considerations, either benefits or penalties, also bear on choices. Our approach has been to itemize all important costs or savings and all important benefits or penalties, and from these itemizations to draw our conclusions.

As the primary data base for our evaluations we have used operating data from the three bases mentioned above. Fiscal data was analyzed in a functional cost analysis presented in Tables 3.1, 3.2, and 3.3.

The simplicity of these tables belies the difficulty of obtaining data on costs. Available records are internally inconsistent with regard to both staffing and costs, and a great deal of effort went into reconciling differences. Military salaries are either omitted from accounting records (at Fort Dix and Jacksonville) or aggregated in ways which did not suit our functional breakdown (at March AFB).

We returned to staff allocations in order to estimate the proper cost allocations for military personnel. Some "free" services, such as laundry service from the Quartermaster Laundry, are not reckoned at all, either by the hospital or the provider of the services. In these cases we estimated the cost by estimating the proportion of the provider's workload produced by the hospital and taking that fraction of the provider's total budget.

The data assembled in these tables provided a basis for estimating the impact of the various potential innovations at each of the three hospitals. It also served as a guide to the functions that are most costly and therefore most worthy of attention.

TABLE 3.1

FUNCTIONAL COST DISTR
WALSON ARMY HOSPITA
FY 1969

	Medicine[b]	Surgery[c]	Obstetrics and Gynecology[d]	Dispensary[e]	Clinics[f]	Dental[g]	Laboratory[h]	Radiology	Pharm
Staff Totals	229	133	32	47	200	167	87	39	
Dentists						58			
						750,000			
Physicians	10	12	3	7	61		3	5	
	150,000	180,000	45,000	105,000	915,000		45,000	75,000	
Registered Nurses	60	23	12		9				
	600,000	230,000	120,000		90,000				
Other Nursing	159	98	17	34	130				
	1,248,816	874,291	150,000	238,000	1,140,848				
Other Professionals						109	79	28	
						590,866	474,565	199,898	105,18
Nonprofessionals				6			5	6	
				30,000			25,000	30,000	5,00
	1,998,816	1,284,291	315,000	373,000	2,145,848	1,340,866	544,565	304,898	110,18
Linen									
Provisions									
Drugs									525,03
Medical Supply	48,011	120,178			184,058	82,591	184,317	94,659	
General Supply	27,701	66,609			39,345	48,438	8,676	179	150
Services	1,597	845			4,587	2,814	1,145		50
Housekeeping[o]	71,938	58,465	27,138	30,270	59,710	17,173	10,644	6,492	3,246
Maintenance[p]	34,308	27,882	12,942	14,436	28,476	8,190	5,076	3,096	1,548
Utilities[q]	42,728	34,725	16,118	17,979	35,465	10,200	6,322	3,856	1,928
Minor Equipment	4,237	7,858			3,330	1,467	6,417	10,278	980
Totals	2,229,336	1,600,853	371,198	435,685	2,500,819	1,511,759	767,162	423,458	643,123
Percent of Total	14.94	10.73	2.49	2.92	16.76	10.13	5.14	2.84	4.31

See following page for explanatory notes.

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TABLE 3.1

ICTIONAL COST DISTRIBUTION[a]
LSON ARMY HOSPITAL, FT. DIX
FY 1969

Radiology	Pharmacy	Food Services[i]	Administration[j]	Records[k]	Sterile	Linens	Other Supply & Support	Totals	Percent Of Total
39	10	148	150	18	11	12	85	1,368	
								58	
								750,000	5.03
5			1					102	
75,000			30,000					1,545,000	10.35
					1			105	
					10,000			1,050,000	7.04
								438	
								3,651,955	24.47
28	9	16	35	4	10	1	13	304	
199,898	105,184	160,000	320,000	28,000	57,364	6,000	104,000	2,045,877	13.71
6	1	132	114	14		11	72	361	
30,000	5,000	1,019,742	806,114	84,000		54,792	430,590	2,485,238	16.65
304,898	110,184	1,179,742	1,156,114	112,000	67,364	60,792	534,590	11,528,070	77.25
						84,111		84,111	0.56
		536,653						536,653	3.60
	525,037							525,037	3.52
94,659			13,883		57,953		31,315	816,965	5.47
179	150	49,211	18,709	2,646		35,369	65,563	362,586	2.43
	50	355	39,073[m]			176,000[n]	5,721	232,187	1.56
6,492	3,246	24,533	31,893	1,623	3,246	1,623	29,440	377,434	2.53
3,096	1,548	11,700	15,210	774	1,548	774	14,040	180,000	1.21
3,856	1,928	14,572	18,943	964	1,928	964	17,486	224,178	1.50
10,278	980	14,173	1,439		870		4,144	55,213	0.37
423,458	643,123	1,830,939	1,295,264	118,007	132,909	359,633	702,289	14,922,434[r]	
							4.70		100.00
2.84	4.31	12.27	8.68	0.79	0.89	2.41	4.70		100.00

Annotations for Functional Cost Distribution at Walson Army Hospital
(Table 3.1)

a. Basic cost data were obtained from special compilations of accounting information prepared by the Management Services Office at our request. Also, the Supply and Services Division supplied estimates of the costs of various services provided without charge to the hospital by other post organizations, such as Engineering, Transportation, and Quartermaster. Personnel distributions were derived from manning lists obtained from the Personnel Division, supplemented by interviews with specific departments on staff utilization. The numbers shown represent full-time equivalents.

   Tubular entries for costs of various categories of personnel were estimated on the basis of approximate averages, distributed in such a way as to make the subtotals consistent with available accounting figures. For example, staff physicians were assigned an average annual compensation of $15,000, registered nurses $10,000, and clerks $5,000. Other personnel cost entries absorbed the necessary remainders of the appropriate subtotals.

   Thus, the personnel cost allocations that are shown are to be regarded as reasonable approximations rather than as precise accounting figures, since the latter were not directly obtainable on a functional assignment basis. It should be noted that the total costs and their breakdowns represent dollars disbursed or transferred, plus estimates of the costs of certain "free" services, such as laundry and utilities. Also, military labor has been factored in from separate accounting records, since these are not directly included in the hospital budget. Labor costs do not include fringe benefits not directly chargeable to hospital or base accounts, such as military retirement, tax advantages, PX and commissary privileges, etc.

b. Includes all inpatient wards other than those in the next two columns.

c. Includes operating rooms, recovery rooms, and surgical inpatient wards.

d. Includes obstetrics, gynecology, and nursery wards.

e. Covers services to active-duty outpatients at nine dispensaries.

f. All general therapy and specialized clinics, other than dispensaries and dental clinics.

g. Includes in-hospital dental service, plus separate post dental clinics.

h. Includes clinical laboratories, pathology, and blood-donor center.

i. Includes dietitians and kitchen personnel.

j. Includes general administrative functions plus public health and veterinary services.

k. Includes direct services involved in inpatient and outpatient record rooms.

l. Supply and other support functions are provided by one organizational division. Available cost accounts do not provide a means for separating these two functional components.

m. Includes travel costs.

n. Estimated cost of laundry service provided by Quartermaster without charge.

o. Contractual housekeeping costs allocated in proportion to the areas utilized by various functional groups.

p. Part of maintenance service is provided by the post without charge; total cost is an estimated value, and is allocated in proportion to area.

q. Most utilities are provided by the post without charge; total cost is an estimated value, and is allocated in proportion to area.

r. Gross total operating costs for FY 1969, including direct expenditures, plus military pay and estimated costs of free services provided by the post.

TABLE 3.2

FUNCTIONAL COST DISTRIBU
JACKSONVILLE NAVAL HOSI
FY 1969

	Medicine[b]	Surgery[c]	Obstetrics and Gynecology[d]	Dispensary[e]	Clinics[f]	Dental[g]	Laboratory[h]	Radiology	Pharmacy
Staff Totals	137	61	73	0	92	9	25	10	63
Dentists						2			
						30,000			
Physicians	17	7	3		42		3	2	
	255,000	102,000	42,000		582,000		45,000	30,000	
Registered Nurses	41	18	28		8				
	328,000	180,000	224,000		80,000				
Other Nursing	77	36	42		42				
	370,455	277,729	256,451		261,506				
Other Professionals						7	22	8	11
						37,580	151,889	56,025	94,528
Nonprofessionals	2								
	10,000								
	963,455	559,729	522,451		923,506	67,580	196,889	86,025	94,528
Linen									
Provisions									
Drugs									318,060
Medical Supplies	19,086	49,643	6,946		38,607	1,965	65,340	43,820	
General Supplies									
Services	8,455	2,166			1,707		4,722		58
Housekeeping[o]	33,109	30,572	11,571		28,066	825	3,302	4,953	1,651
Maintenance[p]	46,460	42,899	16,237		39,381	1,158	4,633	6,950	2,317
Utilities[q]	89,762	82,883	31,371		76,086	2,238	8,951	13,427	4,476
Minor Equipment	2,139	7,633	444		5,693	402	2,860	998	52
Totals	1,162,466	775,525	589,020	0	1,113,046	74,168	286,697	156,173	421,142
Percent of Total	17.22	11.48	8.72	0	16.48	1.10	4.25	2.31	6.24

See following page for explanatory notes.

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LE 3.2

ST DISTRIBUTION[a]
NAVAL HOSPITAL
1969

Pharmacy	Food Service[i]	Administration[j]	Records[k]	Sterile	Linens	Other Supply	Other Support[l]		Totals	Percent of Total
63	11	43	27	4	10	17	38		620	
									2	
									30,000	0.44
		1							75	
		30,000							1,086,000	16.08
									95	
									812,000	12.02
									197	
									1,166,141	17.27
11	3	8	2	4		7			72	
94,528	30,000	100,000	20,000	23,176		70,000			583,198	8.64
	60	34	25		10	10	38		179	
	378,228	283,483	201,629		50,599	60,162	290,116		1,274,217	18.87
94,528	408,228	413,483	221,629	23,176	50,599	130,162	290,116 (-131,661 housekeeping)		4,951,556	73.32 (-1.95)
					15,312				15,312	0.23
	154,394								154,394	2.29
318,060									318,060	4.71
				78,473					303,880	4.50
	33,832	27,782	6,169		6,868	34,641	26,705		135,997	2.01
58	17	44,251[m]		133	7,421[n]	23	84,456		153,409	2.27
1,651	11,571	17,334	825	2,476	825	5,778		(including labor of 131,161)	152,858	2.26
2,317	16,237	24,324	1,158	3,475	1,158	8,108			214,495	3.18
4,476	31,371	46,994	2,238	6,713	2,238	15,665			414,413	6.14
52	2,531	7,965	2,558	441	1,424	32,017	3,507		70,664	1.04
21,142	658,181	582,133	234,577	114,887	85,845	226,394	273,123		6,753,377[r]	100.00
6.24	9.75	8.62	3.47	1.70	1.27	3.35	4.04			

Annotations for Functional Cost Distribution at Jacksonville Naval Hospital (Table 3.2)

a. Basic cost data were obtained from documents provided by the Fiscal Office, primarily quarterly computer printouts of accounting records. Personnel distributions were derived from staff assignment sheets for nursing personnel and from other manning records of the Personnel Office, supplemented by interviews with specific departments on staff utilization. The numbers shown represent full-time equivalents Tabular entries for cost of various categories of personnel were estimated on the basis of approximate averages, distributed in such a way as to make the subtotals consistent with available accounting figures. For example, regular staff physicians and dentists were assigned an average annual compensation of $15,000, residents and interns $12,000, registered nurses $8,000 or $10,000, and clerks $5,000. Other personnel cost entries absorbed the necessary remainders of the appropriate subtotals.

b. Includes all inpatient wards other than those in the next two columns.

c. Includes operating rooms, recovery rooms, and surgical inpatient wards.

d. Includes obstetrics, gynecology, and nursery wards.

e. Dispensary services are operated and paid for by separate commands.

f. General Therapy and specialized clinics operated in and by the hospital.

g. Includes only in-hospital dental services to patients and staff.

h. Includes clinical laboratories, Pathology, and Blood Bank.

i. Includes dietitians and kitchen personnel.

j. Includes general administrative functions, fiscal, personnel, data processing.

k. Includes handling of inpatient and outpatient records and compilation of reports and statistics, plus admission and discharge processing.

l. Includes engineering services, custodial, minor construction, equipment repair.

m. Includes travel costs.

n. Purchased dry cleaning services (hospital operates its own laundry).

o. Allocated in proportion to area.

p. Allocated in proportion to area.

q. Allocated in proportion to area.

r. Gross total operating expenditure for FY 1969.

TABLE 3.3

FUNCTIONAL COST DISTRIBUTION
MARCH AFB HOSPITAL
FY 1969

	Medicine[b]	Surgery[c]	Obstetrics and Gynecology[d]	Flight Surgeon[e]	Clinics[f]	Dental[g]	Laboratory[h]	Radiology	Pharmacy
Staff Totals	90	73	31	9	99	57	22	14	9
Dentists						13			
						195,000			
Physicians	8	4	2	3	30		3	2	
	135,000	60,000	30,000	45,000	483,633		45,000	30,000	
Registered Nurses	28	24	14		8				
	280,000	240,000	140,000		80,000				
Other Nursing	51	43	15	5	55				
	360,000	305,632	105,000	37,959	506,023				
Other Professionals	2	2			5	43	19	11	9
	20,000	20,000			40,000	327,118	213,923	57,941	74,133
Nonprofessionals	1			1	1	1		1	
	5,000			5,000	5,000	5,000		5,000	
	800,000	625,632	275,000	87,959	1,114,656	527,118	258,923	92,941	74,133
Linen									
Provisions									
Drugs									310,641
Medical Supplies						35,492	66,091	51,229	
General Supplies									
Services									
Housekeeping[o]	16,093	10,200	8,000	3,200	12,800	6,200	3,200	2,400	800
Maintenance[p]	11,365	7,200	5,625	2,250	9,000	4,370	2,250	1,690	565
Utilities[q]	7,134	4,500	3,520	1,410	5,630	2,735	1,410	1,055	350
Minor Equipment									
Totals	834,592	647,532	292,145	94,819	1,142,086	575,915	331,874	149,315	386,389
Percent of Total	14.06	10.91	4.92	1.60	19.24	9.70	5.59	2.52	6.51

See following page for explanatory notes

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TABLE 3.3

IONAL COST DISTRIBUTION[a]
MARCH AFB HOSPITAL
FY 1969

Radiology	Pharmacy	Food Service[j]	Administration[l]	Records[k]	Central Sterile	Linens	Other Supply	Other Support[l]	Totals	Percent of Total
14	9	44	69	15	3	3	14	4	566	
									13	
									195,000	3.29
2			1						53	
30,000			30,000						856,633	14.47
									74	
									740,000	12.47
									169	
									1,314,614	22.15
11	9	3	33	2	3		3	1	126	
57,941	74,133	30,000	230,000	15,000	20,000		30,000	10,000	1,088,115	18.33
1		41	45	13		3	11	3	121	
5,000		253,596	212,409	65,000		13,000	55,111	24,000	648,116	10.92
92,941	74,133	283,596	472,409	80,000	20,000	13,000	85,111	34,000	4,844,478	81.63
						7,890			7,890	0.13
		137,000							137,000	2.31
	310,541								310,541	5.23
51,229					84,897				237,709	4.01
							34,552		34,552	0.58
			26,155[m]			78,073[n]		49,149	153,377	2.58
2,400	800	6,400	10,400	800	1,600	800	2,400	1,600	86,893	1.46
1,690	565	4,500	7,320	565	1,125	565	1,690	1,125	61,205	1.03
1,055	350	2,815	4,580	350	700	350	1,050	700	38,289	0.65
								23,034	23,034	0.39
149,315	386,389	434,311	520,864	81,715	108,322	100,678	124,803	109,608[p]	5,934,968	100.00
2.52	6.51	7.32	8.78	1.38	1.82	1.70	2.10	1.85		

Annotations for Functional Cost Distribution at March AFB Hospital
(Table 3.3)

a. Basic cost data were obtained from documents provided by the Business Office, including annual "Hospital Management Summary Cost Analysis and Financial Management" and quarterly computer printouts of accounting records. Personnel distributions were derived from authorized manning tables and from Form 201, Base Medical Staffing Report, supplemented by interviews with specific departments on staff utilization. The numbers shown represent full-time equivalents.

   Tabular entries for costs of various categories of personnel were estimated on the basis of approximate averages, distributed in such a way as to make the subtotals consistent with available accounting figures. For example, except where constraints dictated otherwise, staff physicians and dentists were assigned an average annual compensation of $15,000, registered nurses $10,000, and clerks $5,000. Other personnel cost entries absorbed the necessary remainders of the appropriate subtotals.

   Thus, the personnel cost allocations that are shown are to be regarded as reasonable approximations rather than as precise accounting figures, since the latter were not directly available on a functional assignment basis. It should be noted that the total costs and their breakdowns represent dollars disbursed or transferred and do *not* include fringe benefits that are not chargeable to hospital accounts, such as military retirement, tax advantages, PX and commissary privileges, etc.

b. Includes all inpatient wards other than those in the next two columns.

c. Includes operating rooms, recovery rooms, and surgical inpatient wards.

d. Includes obstetrics, gynecology, and nursery wards.

e. Covers separate Flight Medicine Office.

f. All general therapy and specialized clinics other than dental.

g. Includes Base Dental Clinic, Base Dental Lab, and Area Dental Lab.

h. Includes Clinical Laboratories and Histopathology.

i. Includes dietitians and kitchen personnel.

j. Includes general administrative functions plus public health and veterinary activities.

k. Includes direct services involved in inpatient and outpatient record rooms.

l. Includes plant management and equipment maintenance.

m. Includes travel costs.

n. Purchased laundry and dry cleaning services.

o. Contractual housekeeping costs allocated in proportion to the areas utilized by various functional groups.

p. Allocated in proportion to area.

q. Allocated in proportion to area.

r. Gross total operating expenditure for FY 1969.

4. IMPROVEMENTS IN ORGANIZATION

LIGHT CARE FACILITIES

One of the most striking features of military hospitals is that by civilian standards many of the patients are not very sick and do not require much care. The reasons are easy to find: the military population is young and healthy, having been selected for those attributes; those personnel without their own families do not have homes where they can be cared for during convalescence; and administrative delays sometimes keep patients in hospitals longer than medical needs dictate.

It is possible to capitalize on this special characteristic of military inpatients by providing light care facilities designed especially for not-so-sick active duty male personnel. (From the standpoint of medical need other patients could as well reside in light care facilities, but the administrative simplification sought would be vitiated; active duty males comprise the largest segment of candidates for light care, and the concept can be fully justified on this basis.)

Light care facilities are, of course, not a completely new idea. They have been tried in many places, including a few military hospitals. In the latter cases they have failed to survive as light care facilities because of motivations in a hospital which tend to catch up all wards in the pattern of acute care. The philosophy and organization for light care is just as important as the facilities. Patients in light care facilities are to be regarded as outpatients who for the most part can care for themselves, though they do require supervision and some nursing surveillance.

The light care facility would normally be located adjacent to the acute hospital. Making it a separate building, perhaps connected to the hospital by a bridge or an enclosed pathway, prevents its being casually converted to acute care (although in time of emergency it could be). Keeping it close by the hospital maintains its status as part of the hospital and makes it easy to transfer patients to it. In small hospitals, where the light care facility would comprise 50 beds or less, a separate building cannot be justified, and the light care facility would be part of the hospital building. Other advantages to this scheme are:

- It is near the baggage room, post office, cash office, barber shop, and vending machines, and other facilities at the acute hospital.

- Transportation, change of clothing, passes, etc., are not required when going to the attending medical staff or diagnostic or therapeutic facilities, even when using wheelchairs or crutches.

- There are administrative controls and access to the patient-holding detachment, chaplain, accounting office, and record room.

Presently, male medical and surgical beds amount to 79% of capacity at Fort Dix, 69% at Jacksonville, and 63% at March. Our surveys and analyses of records showed that active duty personnel occupying these beds fall into two major categories:

- Patients being admitted for a very short time, mostly for the treatment of acute respiratory or digestive disorders; and

- Patients remaining for prolonged periods of time, mostly due to orthopedic, digestive, or respiratory conditions (e.g., amputations, fractures, herniorraphies, hepatitis, pneumonia).

Analysis of 29,000 admissions to March, Fort Dix, and Jacksonville shows that long-term cases among the active military patients account for a very high percentage of the total number of hospital days (Table 4.1). We therefore recommend that the light care facility be primarily used for these cases and not for short-term acute admissions of less than 72 hours (which account for only a small percentage of the total number of days).

The patient to be transferred from the acute hospital bed to the light care facility therefore would be:

- A male patient – active military;

- Fully ambulatory, in the sense that he can walk or move (wheelchair or crutches) to have his meals at the cafeteria;

- Free of fever or communicable infection;

- Expected to remain in this facility for at least several days (transferring patients for a very brief period near the end of their hospital stay would not be advisable);

TABLE 4.1

PERCENTAGE OF LONG-TERM PATIENTS AND PERCENTAGE OF DAYS IN HOSPITAL
(Active-duty military patients only)

	ADMISSIONS FOR				PERCENTAGE OF DAYS			
DAYS	11 to 15	16 to 20	21 to 30	31 & up	11 to 15	16 to 20	21 to 30	31 & up
HOSPITAL								
March	3.4%	1.8%	1.8%	5.8%	8.9%	5.3%	8.9%	30.4%
Jacksonville	8.0%	5.1%	5.8%	11.6%	10.2%	9.1%	14.3%	38.1%
Fort Dix	12.8%	7.4%	12.8%	28.4%	8.9%	7.3%	17.4%	63.9%

- Requiring little or no personal nursing care; and

- Able to have with him and take the medication he requires, based on the prescriptions obtained from his attending physician and filled at the acute hospital pharmacy.

The light care facility should have only one or two floors, depending upon size, with ramps for wheelchairs. It should have a semi-domestic environment. Customary standards for air-conditioning and other patient requirements in the area will be maintained. In addition to the bed space, there will be ample space for recreation and occupational therapy. A cafeteria or dining room area will allow all patients to be served. A pantry area mainly for night use and for feeding ulcer patients, is essential. The nurses' station will provide the necessary space for the staff. Its location will allow for control and supervision of access to the facility and for maintenance of order and discipline on the premises. Private rooms will be used by patients of officer status or by those requiring such facilities for medical reasons.

There will be no need for a nursing call system from every bed to the nursing station. We would recommend only one call button per room, located near the door and used only for emergencies. Installing a central "Muzak" type system could be beneficial, at least in certain areas. Conveniently located loudspeakers will be needed to call patients or to transmit instructions. Wheelchair bays will keep wheelchairs out of the way but available when needed. Large amounts of supplies will not be used in the light care facility. The treatment room should be close to the nursing station. A small laundry room for personal clothing is needed.

Patients will be transferred to this light care facility from the acute hospital. No direct admissions will take place except under very unusual circumstances. The patients will be able to walk or move around with wheelchairs and crutches, have showers or baths, use the toilet facilities, and have their meals at the dining room area. Neuropsychiatric patients not requiring the closed facilities at the acute hospital will be accepted here; they will be treated as outpatients in the psychiatric unit at the acute hospital.

Oxygen and suction will be available for emergencies at the light care facility using portable equipment. Other standby equipment, such as defibrillator and tracheotomy tray, can also be kept ready. The nursing staff will be capable of immediate detection of any postoperative complication or new ailment. In such cases the patient can be readmitted to the parent hospital. Volunteers and therapists plus other staff from the acute hospital, will assist at the light care facility.

Operating procedures in the light care facility are to be kept simple. Any results of X-ray or laboratory examinations ordered by the treating physician at the acute hospital will be handled as an OPD case. Although patient charts (normally the same chart used at the acute facility) will be carried at the light care facility, no doctors' rounds will take place. However, it is essential that the ward clerk and supervising nurse see that every patient at the light care facility keep his appointments as arranged.

No meals will be served to patients at their bedside. They will all go to the dining room area. Meals (including diets) will be brought over from the hospital kitchen. Each patient will have his own medication, obtained from the pharmacy with the prescription issued to him. He will take the medication himself as he would do at home. Exceptions, of course, would be made for injectables that will be given by the nursing staff in the facility's treatment room, or any others that require nursing supervision. Bed linen will not be changed with the frequency that is customary in acute hospitals. The patients themselves will do this work with clean linen supplied by the corpsmen.

The light care unit will provide the necessary facilities for recreation needed by those patients who now spend many long hours with nothing to do. It will include a lending library, a TV room, a game room, and an auditorium for movies. A guiding principle is that every patient able to enjoy these facilities should be a patient in the light care unit. Very few, if any, patients in the acute hospital area would be able to use these recreational areas. This in itself has some therapeutic value and will be a strong incentive for moving patients from the acute to the light care facility.

The effect of light care facilities on bed allocations and staffing is shown in Tables 4.2, 4.3, and 4.4. Substantial reductions in nursing staff could be achieved: 49 nurses at Fort Dix, 14 at Jacksonville, and 23 at March AFB.

These reductions would not impair the quality of nursing care. Walson Army Hospital at Fort Dix now provides 2.5 hours of nursing per day for each active duty patient, Jacksonville 2.0 hours, and March 4.0 hours. With the recommended light care facilities and the reduction of nursing staff, a military patient in an acute bed will receive a higher ratio of nursing care: 3.0 hours at Walson, 2.5 hours at Jacksonville, and 4.25 hours at March.

These light care units will cost considerably less to build than comparable space in an acute hospital. In the case of Jacksonville, the 225-bed light care unit has been estimated to cost $1,599,000 instead of $3,040,000 for the equivalent beds in the acute hospital. Furthermore, in case of an emergency the light care unit can be converted into an acute care area at an estimated cost of $660,000 for 144 beds. (The total cost of the converted beds is lower because fewer acute beds can be accommodated in the converted facility.)

TABLE 4-2

EFFECT OF LIGHT CARE UNIT

BALBOA ARMY HOSPITAL

A. MALE MEDICAL AND SURGICAL UNITS
ALSO INCLUDES ARMAC AND PHASE BEDS

	CURRENT			PROPOSED		
	BEDS	PATIENTS	NURSING STAFF	BEDS	PATIENTS	NURSING STAFF
MAIN	705	681	101	705	681	105
LIGHT CARE UNIT	-	-	-	30	20	32
				705	681	137

B. OTHER UNITS FOR DEPENDENTS
INCLUDING MATERNITY, PEDIATRICS
AND SURGERY

101		101
806		806

TABLE 4-3

EFFECT OF LIGHT CARE UNIT

JACKSONVILLE NAVAL AIR STATION HOSPITAL

A. MALE MEDICAL AND SURGICAL UNITS

	CURRENT			PROPOSED		
UNIT	BEDS	PATIENTS	NURSING STAFF	BEDS	PATIENTS	NURSING STAFF
0E OFFICERS	20	20	11	15	7	7
7E SURGICAL	50	47	11	30	23	10
7M MEDICAL	50	31	11			
0E ORTHOPEDIC	50	47	12	50	30	12
6M SURGICAL	50	42	8			
4E CONTAGION	27	10	6	10	10	5
6 PSYCHIATRIC	21	10	9	15	11	6
1 CONVALESCENT	70	60	5	0	0	0
LIGHT CARE UNIT				225	200	70
TOTAL	351	709	74	351	200	84

B. OTHER UNITS FOR DEPENDENTS
INCLUDING MATERNITY, PEDIATRICS
AND SURGERY

153		153

TABLE 4-4

EFFECT OF LIGHT CARE UNIT

MARCH AIR FORCE BASE HOSPITAL

A. MALE MEDICAL AND SURGICAL UNITS

	CURRENT			PROPOSED		
UNIT	BEDS	PATIENTS	NURSING STAFF	BEDS	PATIENTS	NURSING STAFF
1 ORTHOPEDIC	50	45	17	42	30	12
7 MEDICINE	43	11	10	20	11	10
2A PSYCHIATRIC	15	9	10	2	1	7
1 SURGERY	30	33	27	31	20	14
				95	67	63
LIGHT CARE UNIT				30	43	7
	140	100	73	140	100	90

B. OTHER UNITS FOR DEPENDENTS
INCLUDING MATERNITY, PEDIATRICS
AND SURGERY

90		90

TOTAL BEDS 230 230

Operating costs will be significantly reduced, chiefly through reduction in salaries for nursing staff and expenses for linen, laundry, and housekeeping. Estimates for these savings are shown in Table 4.5.

TABLE 4.5

SAVINGS IN OPERATING EXPENSES ATTRIBUTABLE TO LIGHT CARE FACILITY

	Fort Dix	Jacksonville	March
Nurses salaries	$490,000	$140,000	$230,000
Linen and laundry	52,340	17,958	7,300
Housekeeping	60,000	40,000	10,000
	$602,340	$197,958	$247,300

AMBULATORY CARE SERVICES

Primary care or ambulatory services represents the first point of contact of any health service operation. It is also the early warning system by which those responsible for the health care of a population may become aware of changes in the prevalence and incidence of certain diseases or health problems. Reorganization of primary care offers the most immediate hope of increasing productivity of health professionals and alleviating the shortage of medical doctors. By providing alternatives to hospitalization, ambulatory services provide a primary means of controlling the costs of health care.

Our basic recommendation is that ambulatory care on military bases make greater use of nonphysicians (specially trained corpsmen and nurses) to provide the bulk of the primary care in the ambulatory setting, under the supervision and preceptorship of the physician in charge. The ambulatory care center will have sufficient X-ray and laboratory equipment for most of the diagnostic procedures required. To allow sufficient specialization of the corpsmen and utilization of diagnostic equipment in the ambulatory care center, such centers will generally serve at least 6000 to 8000 personnel.* Patients will be referred to the specialized clinics of the acute care hospitals if specialty consultation is needed, or to the diagnostic facilities of the acute care hospital if more complex diagnostics are required. Salient features of the plan are as follows:

- In the case of active duty patients, one physician will be responsible for the services provided by six to eight assistants under his supervision. The key to practical success with this concept is the intent to make the physician the captain of an ambulatory care team.

*On bases with populations less than about 3000 to be served by an ambulatory care center, a separate facility cannot be justified. However, the concepts can be applied in an outpatient clinic.

- The ambulatory care center should be physically separate from the acute care hospital and light care facility in order to give the team a distinct identity; each facility will be responsible for the care of a specified group (generally a population of 6000 to 8000).

- The physician will generally not see patients until they have been seen by an assistant, and then only if (1) the disease or injury is beyond the physician's definition of the competence of each assistant, (2) the physician wishes to instruct, (3) an unusually large load develops, or (4) it is necessary to admit a patient to the acute care hospital (but not, generally, if the patient is only to be sent to the hospital's outpatient department for additional tests or consultation).

- The appropriate facilities for the ambulatory care center depend on the location, but a fully equipped center will contain examining rooms, a pharmacy with a restricted formulary, a laboratory capable of making simple tests, an X-ray unit suitable for chest and extremities, a conference room and library, and a communications center.

- The ambulatory care center staff will include generalist corpsmen (trained at the level of the independent-duty corpsman) and medical specialist corpsmen in orthopedics, podiatry, upper respiratory infections, and dermatology.

The important innovation is not in the physical facility, nor the mere use of assistants, but rather in the concept of a team, headed by a physician working with a supporting staff at the job of providing primary care.

To assure a high level quality of care, the surveillance system should include physician monitoring of process statistics through review of current case histories, spot checks, and meetings with the assistants; and utilization reviews by the hospital commander.

In examining data on primary medical care requirements, we have found that the type of dispensary operations conducted at training bases are in several ways different from those at bases where military personnel have relatively long-term assignments. Moreover, both of these kinds of operations differ from the ambulatory services required by dependents and retirees. We therefore suggest that implementation of our recommendations take place in four stages: first, for active duty personnel at training bases; second, for military personnel at other bases;

third, for dependents and retirees with pediatric, obstetric, psychiatric, and chronic disease problems; and fourth, for dependents and retirees requiring general therapy or primary care. We have excluded "specialized" personnel, such as pilots and submariners, from stage two; they constitute a relatively small percentage of the total military population, and the health support services they require are unique.

The benefits of the ambulatory center can be summarized as follows:

- It can be located close to troop areas or to ships, thereby reducing travel time for patients.

- The physician, in his expanded role as supervisor, gains management experience while he is still relatively young; this early experience will provide some basis for identifying potential command and staff officers in the Medical Corps.

- From the standpoint of organization, the ambulatory care center is like a field unit; as such it provides valuable experience for both medical officers and corpsmen.

- Fewer physicians will be needed to provide care, and the assistants that replace them are less expensive.

- Corpsmen and perhaps physicians should experience greater professional satisfaction.

- This organization keeps the majority of patients who have only minor symptoms away from the more complex acute facilities, where the whole focus should be on major problems.

- Control of ambulatory patients is greater in the center than in the hospital environment.

- This arrangement improves continuity of care; the value of continuity of care, however, has not be established.

While offering a number of advantages, the ambulatory care center may also entail certain drawbacks. For instance, some people believe that the quality of care will be diminished because assistants will have had less training; others assert that quality is enhanced because the assistants are not overtrained for their jobs and do not suffer from boredom. Our survey of outpatient records and review of existing studies revealed little evidence of either diminution or enhancement of the quality of care; at best, this issue must be regarded as undecided. Other disadvantages include the following:

- Our survey indicates that when corpsmen provide primary care, there may be more revisits in an episode; this factor was taken into account in developing staffing estimates.

- Since smaller units are more susceptible to the effects of random fluctuations in demand, the ambulatory care center may experience more frequent periods of overloading and underloading than would a centralized facility.

In the first stage (active duty personnel at training bases), a typical ambulatory care facility, serving a population of 6000-8000, could be laid out as shown in Figure 4.1. Staffing would be altered from the current distribution to reduce the number of physicians and increase the number of corpsmen as shown in Table 4.6. Delegation of responsibilities to the corpsmen could be as indicated in Tables 4.7 and 4.8.

The role of the physician supervisor would be different from his customary role in present dispensaries. He would have the following duties:

- Administers emergency medical treatment to patients who have serious medical illnesses before they are transferred to more specialized facilities.

- Performs triage functions to determine the extent and nature of illness or injuries of patients referred to him by corpsmen.

- Engages in the practice of primary medical care, including the performance of minor surgery (incision and drainage of abscess, sutures, lacerations, etc.), or assumes a supervisory role if these functions are delegated to surgical technicians.

- Is generally responsible for all health-related activities at the dispensary.

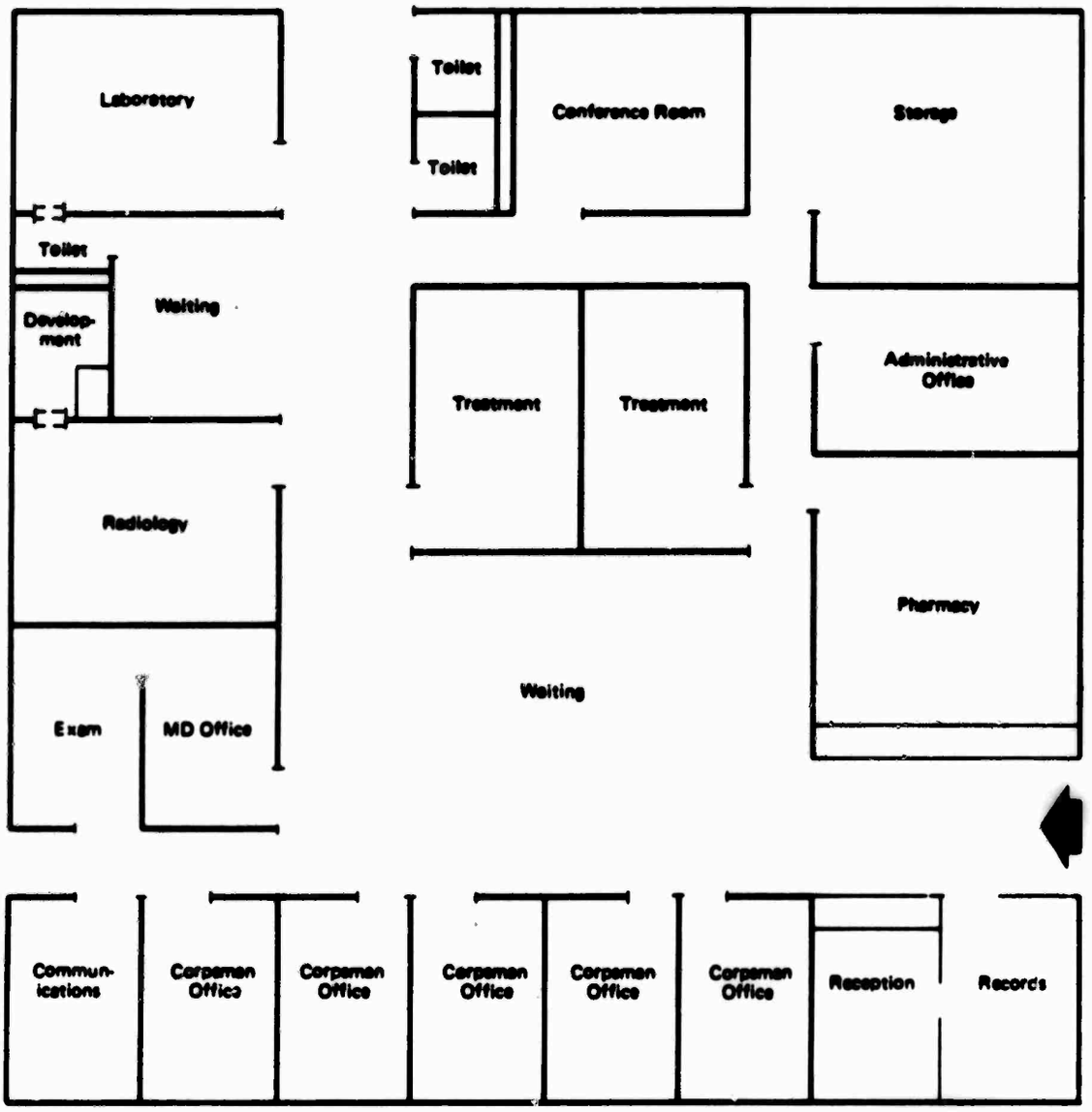


FIGURE 4.1 AMBULATORY CARE CENTER UNIT

TABLE 4.6

AMBULATORY CARE CENTERS – STAFFING
(Training Base)

Population at Risk	3,000	5,000	8,000	10,000	13,000
Visits per Day	100	150	250	300	400
A. Staffing – Current*					
Physician	1	2	3	4	5
Corpsman	3	4	5	6	7
Master Sergeant	0	0	1	1	1
X-ray Technician	–	–	1	2	2
Lab Technician	–	–	1	2	2
Pharmacist	1	1	1	2	2
Records Clerk	1	1	2	2	3
Total Staff	6	8	14	19	22
B. Staffing – Recommended					
Physician	1	1	1	2	2
Corpsman	3	5	7	8	10
Master Sergeant	0	0	1	1	1
X-ray Technician	–	–	1	2	2
Lab Technician	–	–	1	2	2
Pharmacist	1	1	1	2	2
Records Clerk	1	1	2	2	3
Total Staff	6	8	14	19	22

*Based on *Staffing Guide for U.S. Army Medical Department Activities,* Pam 616-557

TABLE 4.7

DELEGATION OF RESPONSIBILITY BY PROBLEM AREA

A. Seen by Physician

Pain/Stiffness of Neck
Shortness of Breath
Chest Pain
Stomach Pain
Rectal Problem
Weight Loss
Eye
Fainted
Ill Defined Vague Complaint/Nervous, etc.

B. Seen by Corpsman

Injury to Extremity/Joint
Pain in Extremity
Back Strain/Pain
Cold/Cough/Sore Throat
Skin Problem
Diarrhea
Loss of Appetite
Gas/Belching/Heartburn
Pain or Difficulty Urinating
Swelling/Pain in Testicle
Headaches
Ear

TABLE 4.8

DELEGATION OF PHYSICAL EXAMINATIONS

Physician	Corpsman	
	x	Vital Signs (Temperature, Blood Pressure, Pulse)
	x	Extremities
	x	Skin
x		Eye
	x	Ear, Nose, and Throat
	x	Upper Respiratory Tract
	x	Genitourinary
x		Cardiovascular
x		Abdomen

- Holds weekly staff conferences with all corpsmen to review a 5% random sample of all recorded corpsmen activities.

- Conducts teaching patient-care conferences in order to review medical pharmacology, techniques of physical examination, and differential diagnoses.

- Assumes responsibility not only for the care of individual patients but also for the surveillance of medical problems within a population (through epidemiologic surveillance techniques carried out by preventive medicine corpsmen).

- Maintains quality control over laboratory determinations through the use of "unknowns" provided by the base hospital laboratory.

The generalist corpsman will be trained at the present level of the (Navy) independent-duty corpsmen. He would be required to have two years of additional on-the-job training in a dispensary setting. Under a physician's supervision, his responsibilities are as follows:

- Takes histories, orders lab tests and X-rays, and prescribes treatment to active-duty personnel.

- Excuses (certifies) patients from duty.

- Refers to the outpatient clinics for consultation and for admission as required.

- Calls upon the local physician for immediate consultation when needed.

Various specialist corpsmen would also be introduced. On training bases three such specialists have been found necessary: orthopedics and podiatry, respiratory ailments, and dermatology and gastrointestinal ailments.

While ambulatory care for active-duty personnel at training bases is the obvious place to start in a program making more use of nonphysicians in primary care, the most significant impact occurs in subsequent stages. Feasible substitutions in the staffing for outpatient clinics are summarized in Tables 4.9-4.11. The ultimate impact on costs is summarized in Table 4.12.

DENTAL CARE

Dental care represents about 10% of the cost of base-level health care at each of the three bases for which we compiled data. It consequently represents a significant component of the base health-care system, and, if these costs can be reduced, it will be worthwhile.

Although the military services presently use one assistant at each operating chair (usually as a hygienist and general helper) for each dentist, plus a variable number of additional assistants, such as clerks and sterilizer operators, there is considerable evidence that dental assistants can be used still more extensively. There have been several experimental programs in which dental assistants were used in expanded roles. These experiments evaluated the quality of care – in particular, the quality of restorations placed, shaped, and polished by assistants. The conclusion was that quality is not diminished, and in some cases even improved (though this result could be attributed to the enthusiasm of the special group).

Basing our calculations on these results, we have computed the economic impact of adopting the methods described in these experiments. The conclusion is that dentists engaged in general or restorative dentistry (who comprise about 70% of all the dentists) can operate most efficiently when they use three operatories, each with a chairside assistant, plus one "roving" assistant.

TABLE 4.9

PHYSICIAN STAFFING OF CLINICS – WALSON ARMY HOSPITAL

Clinic	Average Visits Per Day	Staffing		
		Current	Proposed	
		MD's[a]	MD	MD Substitutes
Medical				
Gastrointestinal	120	11-1/2	7-1/2	4
Cardiology				
Pediatrics	200	11	5	6
Dermatology	25	1	1	
Allergy	45	1	1	
Neuropsychiatry	110	6	5	1
Neurology	40	2	2	
Surgical	60	10	5	5
Orthopedics & Physical Therapy	160	8-1/2	5	3-1/2
Genitourinary	30	4	2	2
Ear, Nose and Throat	50	2	2	
Eye	35	2	1	1
Obstetrics and Gynecology	115	6	4	2
General Outpatient (including Emergency Room	400	13-1/2	5-1/2	8
		78-1/2	46	32-1/2
Wards		9	9	
Support		11-1/2	11-1/2	
Administration		2	2	
		101	68-1/2	32-1/2
Other (including dispensaries)		12	12	
Total		113	80-1/2	32-1/2

a. Including residents. From "USA Medical Department Activities, Fort Dix, N.J., 1 April 1970"

TABLE 4.10

PHYSICIAN STAFFING OF CLINICS – JACKSONVILLE NAVAL HOSPITAL

Clinic	Visits FY 1969[a]	Visits Per Day	Staffing		
			Current MD's[b]	Proposed MD	Proposed MD Substitutes
General Practice	40,700	155	7	3	4
Emergency Room	24,301	65			
Allergy	1,600	6			
Neuropsychiatric	15,200	60	4	4	
Urology	10,000	40	2	2	
Eye (Except Optometry)	6,750	30	2	1	1
Ear, Nose and Throat	7,700	30	3	2	1
Medicine	11,200	45	7	4	3
Dermatology	9,000	35	2	1	1
Surgery	8,600	35	5	3	2
Obstetrics and Gynecology	38,000	145	5	3	2
Pediatrics	28,000	110	7	3	4
Orthopedics	7,800	30	3	2	1
			47	28	19
Interns and Residents			19	19	—
			66	47	19
Support			9	9	
Administration			1	1	—
Total			76	57	19

a. Workload statistics, FY 1969
b. Naval Hospital, Jacksonville, Florida, *Directory of Officers*, August 1969

TABLE 4.11

EXAMPLE OF REORGANIZATION OF
AMBULATORY SERVICES – MARCH AFB HOSPITAL

Clinic	Average Visits Per Day[a]	Staffing		
		Current MD's[b]	Proposed	
			MD	MD Substitutes
General Therapy	150	6	3	3
Emergency Room	95	1	1	
Surgical	40	6	3	3
Orthopedics	50	4	2	2
Ear, Nose and Throat	25	2	1	1
Ophthalmology	15	2	1	1
Urology	45	3	2	1
Obstetric and Gynecology	85	5	3	2
Internal Medicine	25	4	3	1
Pediatrics	100	4	2	2
Neurology	7	1	1	
Allergy	85	1	1	
Dermatology	35	2	1	1
Psychiatric	20	4	2	2
Subtotal		45	26	19
Support		6	6	
Administration		2	2	—
Total		53	34	19

a. Based on "Clinical Data for March AFB," 5-month totals
b. Major B. F. Bauman, private communication, April 1970

TABLE 4.12

PHYSICIAN SUBSTITUTION IN AMBULATORY CARE

Hospital	Total MD's	Clinics	Other	Support Services	Visits Per Year	MD's Substituted	Estimated Annual Staff Savings
March	53	45	2	6	225,000	19	$114,000
Jacksonville	76	47	20	9	225,000	19	114,000
Walson	113	78-1/2	23	11-1/2	425,000	32-1/2	195,000
Total	242	170-1/2	45	26-1/2	875,000	70-1/2	$423,000

In addition, there is considerable merit in using "circular operatories" in which the dental chairs are arranged in a fan around a central hub where an assistant is stationed and supplies are kept. This configuration facilitates the dentist moving from patient to patient and supervising the activities of his assistants.

Taking into account all relevant costs (salaries, equipment, construction, and training), the cost per procedure in restorative dentistry can be reduced from $4.63 to $3.29 by using three assistants per dentist. It can be reduced still further – to $2.58 – by using circular operatories. These costs are not based on a large sample and some of the comparisons are open to criticism. Nonetheless, the differences are large enough, and the results plausible enough, to say that the ideas have genuine merit.

To put the reduced costs for general and restorative dentistry in another perspective, we have evaluated the impact of the above recommendations at Fort Dix, Jacksonville, and March. The impact on staffing is shown in Table 4.13. The impact on costs is shown in Table 4.14. The point of view in these tables is that staff can be changed and productivity held constant. Equally tenable, of course, is a view in which dental officers are held constant and productivity increased.

TABLE 4.13

COMPARISON OF STAFFING UNDER PRESENT
AND NEW PATTERNS OF RESTORATIVE DENTISTRY

	Present Pattern	New Pattern
Fort Dix		
Total Dental Officers	58	32
Dental Officers in General or Restorative Dentistry	40	14
Total Other Professional Staff	109	125
Chairside Assistant in General or Restorative Dentistry	40	42
Roving Assistants	0	14
Support Personnel	15	15
Jacksonville		
Total Dental Officers	32	20
Dental Officers in General or Restorative Dentistry	19	7
Total Other Professional Staff	45	54
Chairside Assistant in General or Restorative Dentistry	19	21
Roving Assistants	0	7
Support Personnel	7	7
March		
Total Dental Officers	13	7
Dental Officers in General or Restorative Dentistry	9	3
Total Other Professional Staff	43	46
Chairside Assistant in General or Restorative Dentistry	9	9
Roving Assistants	0	3
Support Personnel	3	3

TABLE 4.14

SUMMARY OF SAVINGS AND COSTS ATTRIBUTABLE TO NEW PATTERNS IN RESTORATIVE DENTISTRY

	Fort Dix	Jacksonville	March
Annual Savings in Operating Expenses	$280,000	$118,000	$69,000
Additional Capital Costs (Space and Equipment)	302,000	129,000	56,000
Annual Savings Including Amortization of Capital Costs	267,000	107,000	64,000

5. HOSPITAL SERVICES

The major impact of technology on military health care is in the area of hospital services – matters indirectly related to patient care, including practices in laboratory, radiology, pharmacy, food service, linen service, materials handling, and information handling. For these functions, modern technology offers some novel alternatives, some of which can provide significant benefits to military hospitals.

AUTOMATED MATERIALS HANDLING

Dozens of systems for moving materials in hospitals are now available in the United States. For convenience, these systems can be grouped by type; within any one group, the kinds of materials which can be handled and the costs of installation and operation are generally comparable. The generic systems we considered were the following:

- Manual systems, in which carts are moved by hand from place to place in the hospital, using elevators for vertical travel.

- Automatic module systems, typified by Cyberail, Amscar, or ACTS (Automatic Cart Transport System), in which a module large enough for most bulk items moves automatically to its destination.

- Semiautomatic module systems, in which vertical delivery uses a dedicated elevator and is fully automatic, and horizontal movement is manual.

- Tote box systems, in which boxes with a capacity of 1 or 2 cubic feet move automatically on conveyor belts and chain lifts to the destination coded on the box.

- Telelift, a unique system, in which boxes with a capacity of 1 or 2 cubic feet move automatically on a monorail, both vertically and horizontally, to a destination coded on the box.

- Pneumatic tube systems, in which containers (usually cylindrical and large enough for papers, drugs, or specimens) are blown or sucked through pipes to the destination encoded on them.

- Vacuum collection systems, in which trash and soiled linen are collected through chutes and a horizontal high-capacity vacuum collection system.

- Trayveyor systems, designed primarily for food service, in which trays are moved horizontally on conveyor belts and vertically on chain lifts.

Our approach to evaluation of existing systems is based mainly upon costs. However, the following attributes also have a bearing on selection:

- Flexibility
- Reliability
- Adaptability to building spaces
- Suitability as retrofits
- Consonance with the hospital environment.

These characteristics had a tempering influence on our choices.

Costs to install and operate the systems were solicited from manufacturers. While these costs do not appear unrealistic to us, we believe that they should be regarded as lower limits. Comparative annual operating and amortization costs are given in Table 5.1.

TABLE 5.1

COMPARATIVE OPERATING AND AMORTIZATION COSTS FOR MATERIALS HANDLING SYSTEMS

	Fort Dix	Jacksonville	March AFB
Manual	$153,000	$112,700	$ 95,300
Automatic Module	210,000	155,200	102,000
Semiautomatic Module	163,400	121,550	96,300
Tote Box	185,000	122,300	110,300
Telelift	174,700	118,000	104,700
Pneumatic Tube	180,400	132,000	112,200
Vacuum Collection*	150,800	110,700	93,700
Trayveyor	145,250	101,050	87,600

* This does not include the cost of disposal beyond the collection point.

On the basis of cost, one is led to discard all systems as alternatives to a manual system except vacuum collection systems. Trayveyor-like systems for food trays, and pneumatic tube systems for paperwork. However, we have analyzed the cost of moving paperwork and have concluded that manual transport is generally cheaper. Even if this were not so, we believe that investment in mechanical means for moving paper is unwarranted, because a substantial part of the paperwork will shortly be taken over by computer-based communication systems.

DISPOSABLE LINENS

Disposable linens for hospitals have received wide attention as an alternative to conventional linens. We have summarized the advantages and disadvantages of each and concluded that, with a few exceptions, disposable linens are both more costly and less satisfactory than reusable ones. The arguments can be summarized as follows:

- Disposable linens, including bedsheets, pillowcases, washcloths, patient gowns, lab coats, service dress, surgeons' gowns, scrub shirts, and scrub pants cost from two to three times as much as reusables when the costs of replacement, laundering, ironing, and sterilization are included; the major exception is diapers, both kinds of which cost about the same.

- The costs of disposables are unlikely to decrease; future developments are expected to concentrate on improving quality rather than reducing costs.

- In general, disposables are inferior to launderable linens with regard to feel, drape, strength, porosity, and absorbency.

- There is some additional convenience to using disposables, especially items which become heavily soiled such as diapers, but this convenience is not readily equated with tangible benefits such as staff reductions.

- Disposables may reduce problems with contamination or poor sterilization, but there is no convincing evidence that equal infection control cannot be maintained with reusable items.

NURSING SERVICES

The major recommended changes in nursing services are (1) elimination of some positions by introducing light care facilities and (2) providing some assistance to the nursing staff through the use of computers in clinical care. By and large, we found the standard of nursing and the caliber of nursing staff in military hospitals to be very high. Nevertheless, there are some changes which may produce modest reductions in cost or modest improvements in quality of care.

We believe that there are advantages to using ward clerks to relieve nurses of many clerical tasks, at least until computer systems are effective in this role. Similarly, there are advantages to using unit managers (wardmasters) for similar purposes, e.g., providing non-nursing services to patients; managing admissions, transfers, and discharges; and managing housekeeping details, supplies, and requisitions.

ELIMINATION OF OBSTETRICAL SERVICES

One conceivable avenue to reducing the costs of providing health care to military personnel, their dependents, and retirees is to eliminate certain services, providing them instead through CHAMPUS. Because obstetrical services serve no direct military need and because they usually form an isolable service, both organizationally and physically, they are natural candidates for elimination.

After analyzing all relevant costs – physicians and nursing staff, maintenance and utility costs, lab tests, facility amortization, supplies, linens, food, and overhead – we found that the cost per delivery (including prenatal care) at Walson Army Hospital is $330, at Jacksonville Naval Hospital, $332, and at March AFB, $392. Costs for equivalent services under CHAMPUS are about $500 per delivery, of which the patient pays $25, making the cost to DOD about $475. Thus, CHAMPUS costs are generally higher.

However, when the population cared for is so small that the number of births drops below about 500 per year, CHAMPUS becomes a cheaper alternative. To some extent, DOD can take advantage of this fact by not providing obstetrical services in its smaller hospitals, if adequate civilian obstetrical services are available in the area. This view is, of course, weakened by the fact that under present draft laws DOD obtains the services of many obstetricians and gynecologists for whom it has an obligation to provide appropriate professional experience. Furthermore, since the missions of military bases sometimes change, the patient population can change suddenly, and the number of births can change as well. As a general conclusion, therefore, elimination of obstetrical services from military hospitals is not usually warranted.

Using this result as a guideline, we believe that the total cost of health care for the military population is unlikely to be reduced by dropping services from military hospitals.

COMPUTER-BASED COMMUNICATIONS

In this and the succeeding five sections we consider applications of computers for various aspects of clinical practice. Some of these applications are well developed, and we can be quite definitive about their merits or deficiencies; others are still experimental. Computer-based communications fall into the latter category.

On the basis of experience so far, it is not possible to justify the cost of computer-based communication systems or to be certain that the benefits they promise will be realized. Nevertheless, we can see no essential barriers to their ultimate success, and we believe that DOD should participate in their development. This should be regarded as an experimental program aimed at obtaining data for cost-benefit analysis and adapting such systems to the special conditions in military hospitals. (For example, accumulating costs for individual patients receives a great deal of attention in civilian hospital information systems but is wholly irrelevant in military hospitals.)

With this in mind, we recommend installation of a computer-based communication system in the prototype hospital. It should embrace the following functions:

- Recording data on admissions and patient transfers and maintaining a bed census;
- Recording and forwarding to the laboratory all test requests, and generating specimen collection schedules and lab work plans;
- Recording lab results, either automatically from automatic equipment or manually from non-automated equipment (excluding, of course, those performed on fast analyzers, as discussed in Section 7.6) and maintaining cumulative records for a week;
- Recording and forwarding to the pharmacy all inpatient prescriptions, printing labels, and other data for drug deliveries from the pharmacy, and providing drug administration worksheets for nurses;

- Recording requests and scheduling appointments in radiology and accepting results, including free text recorded and entered by a stenographer;

- Recording all nursing orders from physicians and providing a care plan for each inpatient;

- Issuing reminders to nurses, lab personnel, etc., for work not completed and recorded after specified intervals, and reminders of medications or other actions due;

- Recording schedules for outpatient visits to clinics and generating appointment schedules for each physician in the clinic;

- Generating a shift summary of nursing notes for nurses' signatures and a 24-hour summary of nursing notes for each inpatient;

- Logging dispatch and receipt of record folders and X-rays, using an optical or magnetic reader of special labels on each such folder; and

- Generating a discharge summary from internal records at time of patient discharge.

Although a total information system is conceivable, we believe that DOD should not try at this stage to include all computer applications in a single system. Succeeding sections describe additional applications to be approached separately, deferring for a time incorporation into a larger system.

Before turning to these, we shall mention one other novel kind of communication in hospitals – namely, using television for remote consultation. This has been tried experimentally and, while no formal evaluations have been completed, the program has been considered successful enough for continuation and expansion. The major benefit lies in convenience for the patient, who does not have to make the trip to the hospital for consultation with a specialist. The problems which exist are procedural rather than technological. Since referral from a dispensary to a hospital clinic typically involves at least half a day of a patient's time and a TV link could reduce that time substantially, we recommend that remote TV consultation be tried between the prototype hospital and at least one of its satellite dispensaries.

MULTIPHASIC TESTING

Multiphasic testing, typified by the Kaiser system, is an alternative to the conventional periodic physical examinations now given by the military services to their personnel. Multiphasic testing uses the computer to log all data collected and to produce a comprehensive, accurate, and legible report in which all abnormal findings are flagged. The multiphasic tests are a prelude to examination by a physician.

TABLE 5.2

SUMMARY OF ANNUAL COSTS FOR PHYSICAL EXAMINATIONS

	Kaiser	PES
Personnel	$148,000	$136,000
Supplies	62,000	30,000
Services	47,000	36,000
Equipment Amortization	27,000	6,300
Computer	108,000	–
	$392,000	$208,300
Cost per exam (24,000 exams annually)	$16.30	$8.69

In Table 5.2 we compare the costs of multiphasic testing with the customary way of administering physical examinations. The costs are so disparate that we do not believe that computer-based multiphasic testing has a role in base-level military hospitals. This conclusion is strongly influenced by the fact that the military population is generally young and healthy, having been selected for those attributes. Were this not the case, the value of more thorough physical examinations might justify the cost. In the future, as physiological processes become better understood and more tests become part of standard examinations, this conclusion may be altered.

UNIT PACKAGE MEDICATIONS

Pharmacy operations account for between four and six percent of the operational costs of military hospitals. Since most of this expense represents the cost of drugs, a matter outside the scope of this study, large reductions in pharmacy costs cannot be expected.

On the other hand, the consequences of errors in drug administration can be serious; studies have shown that errors are not uncommon. Therefore, there is merit in attacking this problem. We have also noted that the filling of outpatient prescriptions accounts for between 70% and 90% of the volume of military pharmacies, and any innovations should seek improvements in this area as well.

Unit packaging is promising, both for reducing errors and for facilitating filling outpatient prescriptions. In this technique, common drugs (about 200 of which account for 80% of the orders written) are individually packaged on a paper strip.

To dispense outpatient prescriptions, we have envisioned a computer-driven machine in which some 200 commonly prescribed drugs are kept. The computer accepts card-encoded transcription of the original prescription, and records are kept on cards.

There are many other pharmacy functions which might be computerized. We recommend development of a computer system to maintain inventory data and drug data. It is generally our philosophy that new developments of this kind should be attempted on a "stand-alone" basis; that is, the pharmacy computer at first should not be directly interactive with the communications computer, although the latter would, of course, have a terminal in the pharmacy.

AUTOMATION IN THE CLINICAL LABORATORY

The clinical laboratory, especially the chemistry laboratory, has received much attention from developers seeking to automate test procedures. Technicon is perhaps the best known of these companies, but it has numerous competitors, and new developments are appearing frequently. Military hospitals are already taking advantage of many of the commercial offerings.

In investigating "fast analyzers," we have come to the conclusion that they hold far more promise in speeding up chemistry determinations than has so far been realized. One can envision a fast analyzer system comprising several terminals (in dispensaries, clinics, and wards) and a central computer; this system would eliminate the need to transport patients or specimens to the laboratory and would provide virtually instantaneous determinations. It would require development, but it appears well worthwhile.

Computer systems in the clinical laboratory for logging in requests, making work plans, accepting results from automated equipment, making necessary computations, and printing or transmitting results are available from at least five commercial suppliers. While we doubt that such systems can be justified on the basis of reduction in personnel, they do offer undeniable benefits in the quality of results, arising from the ease with which additional standards can be run, the strict adherence to routine demanded by computer systems, and the absence of human degradation due to fatigue. We believe that computers in this application should stand alone until communications computers are better developed.

OTHER COMPUTER APPLICATIONS

We have reviewed several other computer applications for military hospitals:

- Report composition
- History-taking
- Computer-aided diagnosis
- Electrocardiographic analysis
- Appointment scheduling
- Nurse duty scheduling

For the most part, these applications are too new for us to be definitive about their merit. However, all have been developed and put into pilot operation, at least in restricted areas. The first three present a challenging opportunity for development on the part of the military medical community. While we cannot recommend them as proven tools in medical practice, their promise is great, and the Department of Defense may wish to contribute to their development, particularly in specialties like neuropsychiatry, which are especially important to military medicine.

CONVENIENCE FOOD SERVICE

Food service represents one of the largest single categories of expense in both capital outlays and operation. Convenience foods offer an alternative to conventional food service which is cheaper both in capital investment and in operation. Although there is some basis for doubt, existing convenience food services have proved that quality, variety, and adherence to hospital standards need not suffer in well-run systems.

With a convenience food service, the preparation and portioning of food is done in the supplier's plant. Freezable foods (which include most entrees and cooked vegetables) are delivered frozen, and stored. A day ahead of time they are allowed to thaw; the meals are then delivered to the wards or cafeterias, where they are heated in microwave ovens at serving time. Non-freezable items such as salads, fruit, and milk are delivered daily in single-serving packages for assembly on meal trays. Coffee, tea, toast, and soup are prepared in individual amounts when meals are served. There is no kitchen in the hospital except for a vestigial kitchen for occasional special items.

Having reviewed carefully the merits and potential disadvantages of convenience foods, we have concluded that they are distinctly preferable to conventional foods in most military hospitals. An analysis of costs, summarized in Table 5.3 shows that convenience foods are markedly cheaper.

TABLE 5.3

COMPARISON OF COSTS BETWEEN CONVENTIONAL AND CONVENIENCE FOOD SERVICE SYSTEMS

	Fort Dix	Jacksonville	March
Operating Cost per Ration			
Conventional	$4.72	$4.90	$4.39
Convenience	3.73	4.17	3.85
Difference	$0.99	$0.73	$0.54
Capital Cost			
Conventional	$1,551,000	$811,000	$453,000
Convenience	1,195,000	626,000	340,000
Difference	$ 366,000	$185,000	$113,000

6. IMPROVEMENTS IN FACILITIES AND PLANNING

Military hospitals tend to become prematurely obsolete because they are built in accordance with outdated guidelines, they take an inordinate amount of time to plan, and they are inflexible to change after construction is complete.

In this section we suggest improvements in acquisition procedures for military hospitals which, together with the adoption of advanced building methods, will result in a facility compatible with the demands of contemporary medicine while meeting the special constraints of military procurement and operational procedures. Had the recommended procedures been in effect in 1970, they would have reduced the $60 million expenditure on construction of military hospitals by an estimated $1.6 million.

Since the one certain characteristic of the future is that requirements for facilities and technology for buildings will change, we have emphasized the planning process more than the plans. To achieve the goal of upgrading the quality and utility of the military health care facilities and achieving demonstrable savings, we recommend the following:

- Initiation of an improved *comprehensive systems management and design* approach to the acquisition of health care facilities, embodying innovative features in the planning process, simplified review and approval procedures, and issuance of more detailed design and performance information to the Architect/Engineer and the building contractor.

- Development of *planning units* as integral and fundamental components of the new planning process, developed under the auspices of the SGO; the Planning Unit would incorporate cost, space and performance data, and would materially improve all planning, design, evaluation and decision-making procedures.

- Adoption of *modular building principles* which facilitate reconfiguration.

- Initiation of a systematic *information feedback* procedure as an essential and continuing function of the acquisition process.

- *More adaptability in planning and design*, encouraging incorporation of new data and technology into every new project throughout its acquisition period.

- Use of *computer-aided analysis* to achieve better building layouts, taking explicit account of user requirements, site utilization, and economy.

- Use of *long span roof and floor trusses* to give unencumbered floor space and *interstitial space* for major building utility and service distribution.

- Adoption of *multi-track scheduling* for improved construction contracts, greater control over the project, and a shorter time span between design and beneficial occupancy.

Present acquisition procedures require two approvals at the OSD level (from the Hospital Planning Review Board) and one at the BOB level during the early planning stages. The information contained in documents associated with these approvals is largely tentative and undeveloped except for those elements which experience has taught influence budget approvals. The procedure is costly in terms of time and effort, and usually subject to substantial revision during the subsequent stages of the acquisition procedure. It is possible through introduction of planning units to streamline these procedures.

Development of a data bank contained in planning units for all departments of military hospitals is proposed. The Planning Unit is a standard module of area (approximately 1,200 square feet and is independent of department size), to which measurable quantities of performance output, cost, personnel and other resource inputs, and peripheral support requirements are assigned on the basis of experience. The assigned values would be derived from comparison of design criteria with actual performance of existing facilities. The information contained in the planning units would be kept current through continual feedback of information from operating hospitals.

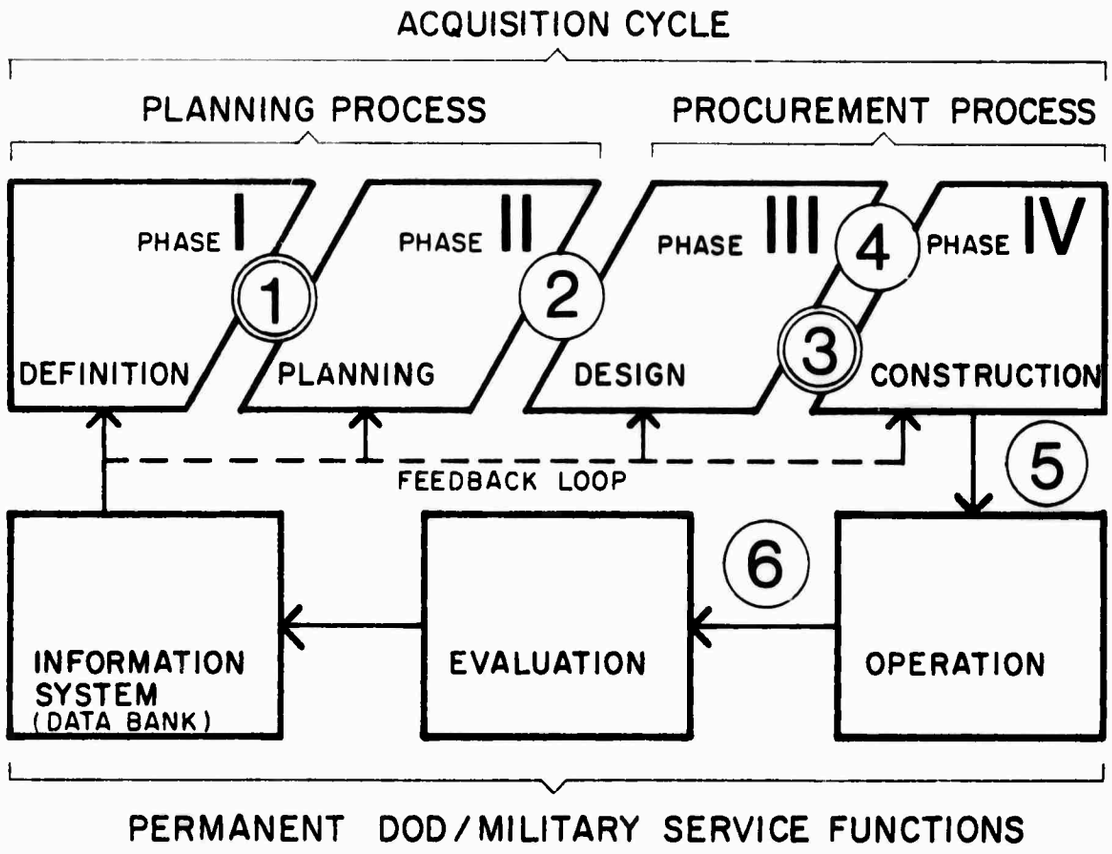
Thus, once the performance needs of a new facility are identified (using present Base Planning Review Board procedures), information can be drawn from the data bank of Planning Units, and assembled as a detailed quantitative profile of the new facility. The resulting Project Summary Chart would assist in replacing both the present Project Proposal and the Preliminary Study documents with one proposal document, and would contain data sufficiently detailed and accurate to be used as a basis for Congressional budget review.

The second phase of the planning process follows the time-honored procedure of requiring an architect to interpret a written space program of requirements, matching his understanding of user needs to an intuitive approach to building design. We believe that it is possible to improve on this procedure by using computer assistance in analyzing and resolving conflicting requirements for the physical proximity of departments within the building and by using form diagrams as the preliminary description of the new building for the architect.

In the design phase modular principles can facilitate both design and, ultimately, construction. The modular concept in no way usurps the architect's traditional responsibility of designing an aesthetically congenial environment in a building of unique character. Designing a building amenable to internal change and possible external expansion during the facility life span does, however, call for new thinking.

Modularity in design makes possible overlapping the design phases with construction. This is called multitrack scheduling. In the construction phase work may begin up to four months or more prior to the issuance of final working drawings. A feature of the proposed building system is that detailed design of interiors can be left until later in construction.

In summary, the proposed acquisition cycle abandons the present linear procedure in which each new step is contingent upon completion of the previous step, and where all delays are cumulative. Instead, it proposes adoption of techniques that will eliminate many of the present steps and permit overlapping of the sequential phases. Adoption of the recommendations in this report can reduce the time span of the procurement period from the present 5-6 years to perhaps 3 years. The principal steps of the proposed acquisition cycle are listed in Figures 6.1 and 6.2.



DOCUMENTATION (Phase Objective)

1)* Project Summary Chart - Performance and budget estimate prepared by SGO for decision and submission to BOB, OSD, and congressional approval as part of the Project Proposal.

2) A/E Contract Documents Package - Design instructions, Form Diagrams, and Departmental Performance Records prepared by SGO for Architect/Engineer.

3)* A/E Design Drawings and Estimates - Detailed Concept Plans and construction cost estimates prepared by A/E for SGO, OSD, BOB approvals.

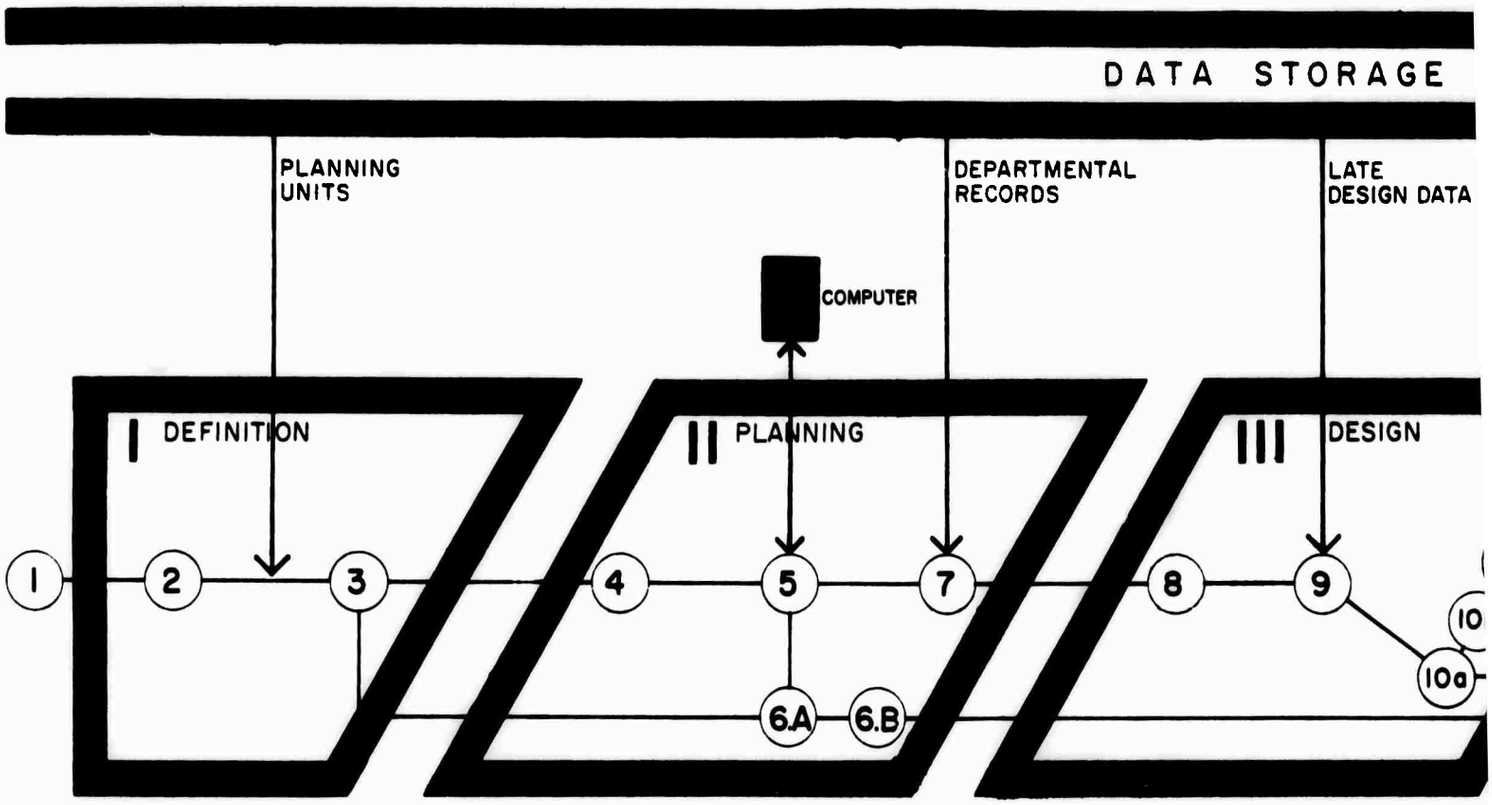
4) Working Drawings and Specifications - Prepared by A/E for phased construction contract bids and site construction.

5) Acceptance Documentation - Formal facility acceptance for beneficial occupancy.

6) Post Occupancy Evaluation & Operating Reports - Prepared by operating military bases and the individual military service for use in evaluation by DOD/SGO to update information system.

* Major approval steps

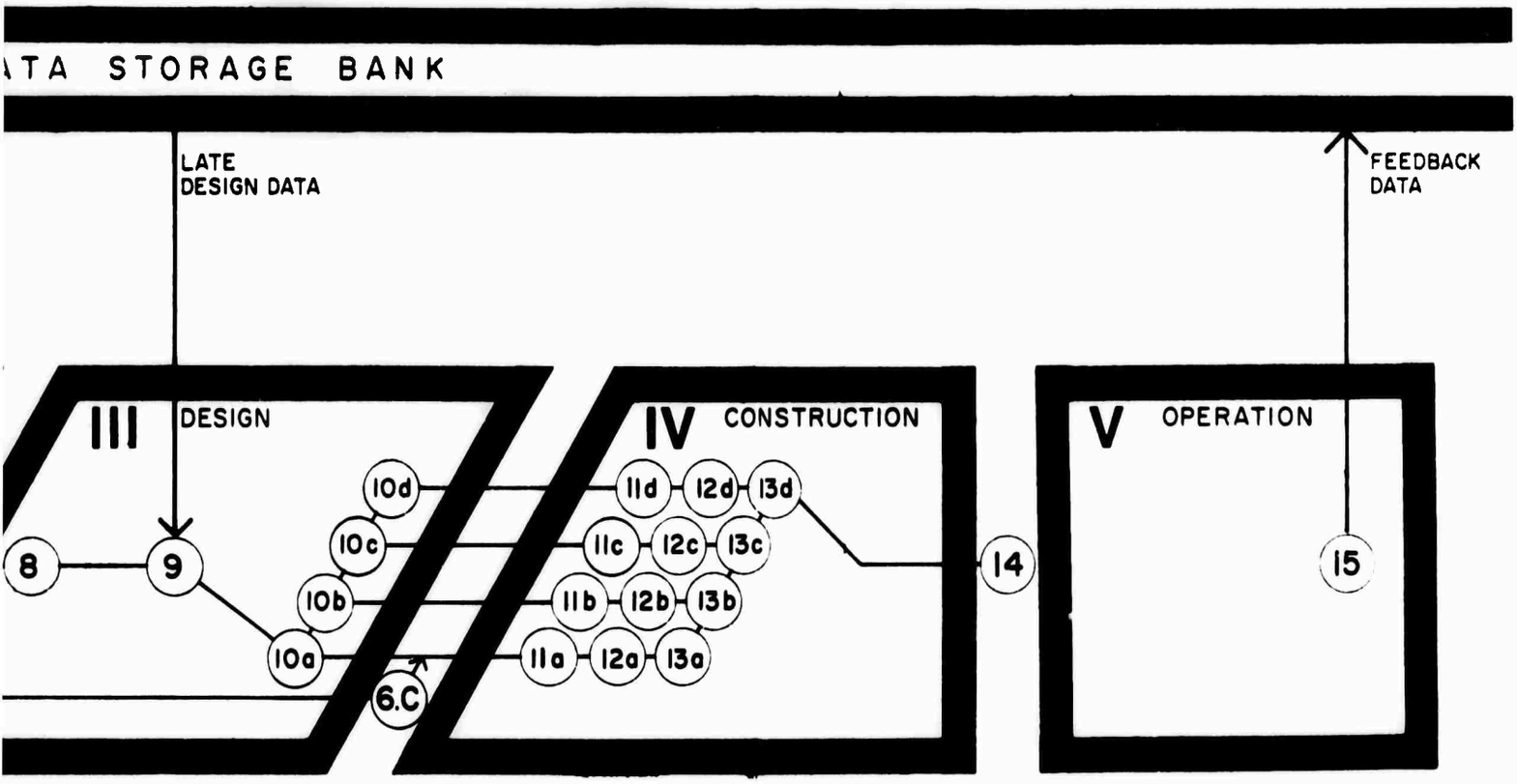
FIGURE 6.1 SCHEMATIC OVERVIEW OF ACQUISITION CYCLE AND PERMANENT FUNCTIONS



1. Base requests new facility
2. SGO reviews request and authorizes preparation of Project Summary Chart
3. SGO prepares and reviews Project Summary Chart based on Planning Unit data
4. SGO generates computer input data
5. Generate Form Diagrams
6.A Generate Project Budget estimate
6.B SGO submits Project Summary Chart to OSD for BOB and Congressional approval
6.C Latest point for receipt of BOB and Congressional approval
7. SGO and Project Officer assemble A/E Contract Document Package
8. SGO and Project Officer transmit A/E Contract Document Package to A/E Contractor
9. A/E develops Detailed Concept Drawings and submits to SGO for approval
10. A/E begins phased working drawings
    a. foundations
    b. structure
    c. enclosure
    d. interior

FIGURE 6.2 PRINCIPAL STEPS IN THE PRO

A



ect Officer transmit A/E Contract
kage to A/E Contractor

Detailed Concept Drawings and
O for approval

hased working drawings
itions
ure
sure
or

11. Project Officer obtains construction bids and awards contracts on phased construction basis
    a. foundation
    b. structure
    c. enclosure
    d. interior
12. Off-site fabrication of modular building components
13. Site construction work
14. Acceptance of facility for beneficial occupancy
15. Periodic post-occupancy evaluation

6.2 PRINCIPAL STEPS IN THE PROPOSED ACQUISITION CYCLE

B

Arthur D Little Inc

7. TOTAL IMPACT OF REORGANIZATION ON COSTS

In Table 7.1 we have assembled the savings attributable to our major recommendations for changes in base-level military health care:

- Introduction of light care facilities
- Reorganization of ambulatory care to make more use of non-physicians.
- More extensive use of dental assistants
- Vacuum trash and linen collection
- Introduction of wardclerks and wardmasters
- Introduction of unit package medication
- More automation in clinical laboratories
- Use of convenience foods
- Innovations in the planning process.

Omitted from this list are most of the computer applications to clinical practice. In this case, we have simply lacked convincing data for estimating their impact.

TABLE 7.1

MAJOR IMPACT ON COSTS
(thousands of dollars)

	Fort Dix		Jacksonville		March	
	Capital	Operating	Capital	Operating	Capital	Operating
Existing System	$17,054[a]	$14,922[b]	$11,840[c]	$6,753[b]	$6,740[d]	$5,935[b]
Savings with Reorganized System						
Light care[e]	$ 1,935	$ 602	$ 1,441	$ 198	$ 277	$ 247
Ambulatory care[f]	—	195	—	114	—	114
Dental assistants[g]	(302)*	280	(129)	118	(56)	69
Vacuum trash and linen collection[h]	(357)	26	(183)	14	(189)	14
Nursing services[i]	—	60	—	30	—	18
Unit package medication[j]	(173)	(15)	(168)	(5)	(166)	(10)
Laboratory automation[k]	(84)	24	(69)	13	—	—
Convenience foods[l]	366	384	185	98	53	113
Totals	$ 1,385	$ 1,556	$ 1,097	$ 580	$ (81)	$ 565
Percent change	-8	-10	-9	-9	+1	-10

*Figures in parentheses represent additional costs rather than savings

a. Original construction in 1960 at Walson Army Hospital cost $8,604,000 and equipment $2,154,000; capital additions since, the bulk of which occurred in 1965, have cost $1,797,000 (see Sections 3.2.3 and 8.1.2.1). By applying a building cost inflation factor of 1.46 between 1960 and 1970 and of 1.28 between 1965 and 1970 from *Engineering News Record*, we arrive at the capital cost shown, which should be regarded as replacement costs; equipment costs were not inflated.

b. Total annual operating expenses for FY 69.

c. Original construction in 1967 at Jacksonville cost $8,922,000 and equipment $940,000. By applying an inflation factor of 1.22 between 1967 and 1970, we arrive at the capital cost shown; equipment costs were not inflated.

d. Original construction in 1965 at March AFB cost $4,715,000 and equipment is estimated at $700,000. By applying an inflation factor of 1.28 between 1965 and 1970, we arrive at the capital cost shown; equipment costs were not inflated.

e. Savings in capital cost of $1,441,000 at Jacksonville were estimated with some care by staff of Lester Gorsline Associates. Savings in capital costs at Fort Dix and March AFB were estimated by scaling savings in proportion to the number of beds involved in the light care facility; savings in operating costs reflect items shown in Table 4.5 (nursing personnel, linen and laundry, and housekeeping).

f. No change in capital costs for reorganization of ambulatory care has been noted, since facilities are incidental to the concept. Operating savings were derived in Table 4.14 which used $6000 as the annual saving when a non-physician is substituted for a physician.

g. Costs taken from Table 4.16. They include the increment to capital costs for circular operatories and the reduction in salaries owing to displacement of dental officers by dental assistants offset by the cost of additional training.

h. Costs developed from data in Table 5.1: capital expenses include purchase and installation of collection system. No change was made in number of carts, since they are still needed for local pick-up. Operating expenses reflect staff savings less maintenance and power costs for vacuum system.

i. Changes in operating costs reflect salary differences between nurses and wardclerks or wardmasters.

j. Additions to capital and operating expenses reflect additional costs for unit packaging (15% of the cost of drugs) and additional technicians in the pharmacy, diminished by savings in nursing staff. The increase in capital cost is accounted for mainly by computer costs.

k. Additional capital costs and operating savings reflect introduction of more automated equipment in the chemistry laboratory.

l. Savings in capital costs are taken from Table 5.3. Savings in operating costs are taken from the same table, with the cost per ration multiplied by 388,000 rations per year at Fort Dix, 134,600 at Jacksonville, and 98,900 at March AFB.

8. PROTOTYPE HOSPITAL AND FUTURE RESEARCH AND DEVELOPMENT

The prototype hospital, to be built with construction commencing in mid-1972 at a location not yet specified, will serve for experimental evaluation of new concepts.

To outline the scope of changes recommended as a result of this study, our conclusions have been summarized in five groups:

Concepts with important savings and benefits

- Light care facilities
- Reorganization of primary (ambulatory) care to make more use of nonphysicians (corpsmen and nurses with special training)
- Use of more dental assistants, with more training, enabling them to place restorations
- Full use of convenience foods
- Modular design and multitrack scheduling

Concepts with modest savings and benefits

- More use of automated equipment including computers in the clinical laboratory
- Vacuum trash and linen collection
- Unit packaging of medications and automated dispensing
- Planning units and computer-aided layouts.

Concepts which appeared attractive but are demonstrably inferior to present practices

- Multiphasic testing
- Wholesale use of disposable linens
- Automated materials handling

- Computer-controlled patient monitoring systems
- Elimination of obstetrical services.

Concepts which appeared promising but which are probably unworkable, unrealistic or unimportant (at least for now)

- New incentives for efficiency on the part of staff of military hospitals
- Full-scale management information system

Concepts insufficiently developed to be certain of their merit but with enough promise to warrant further R&D

- Remote consultation by television
- Automated hospital information system
- Computer applications such as history-taking, report composition, computer-aided diagnosis, appointment scheduling, and duty scheduling for nurses and other personnel.

Thus, the scope of changes recommended includes concepts with important or modest savings and benefits, and, ultimately, concepts refined by further R&D. The scope excludes those concepts definitely or probably found wanting. In a few words, practice in hospitals of the "new generation" will use fewer staff (because of the light care facilities), will make more use of nonphysicians and dental assistants, and will be considerably more automated through the use of computers, automatic analyzers, convenience foods, and vacuum trash and linen collection.

Some concepts will require further R&D before they are ready for experimental evaluation. These have been identified and summarized in Table 8.1. A schedule for further R&D and for the planning and construction of the prototype hospital is shown in Figure 8.1.

Having reviewed building systems applicable to military hospitals, we have concluded that the system under development by the Veterans Administration is the best among those presently available. As far as the prototype hospital goes, the VA system is the most promising because it will be available in time for construction commencing within two years or so. Adopting this system in no way prevents DOD from developing its own system and in fact it provides a good starting place for further work.

TABLE 8.1

SUMMARY OF FUTURE RESEARCH AND DEVELOPMENT

Computer System Developments	
Automated communication system for clinical data	S+
Automated appointment scheduling	S
Nurse duty scheduling	S
Automated inventory keeping for supplies	S
Pharmacy computer system	S+
History taking	-
Report composition	-
Computer aided diagnosis	-
Equipment Developments	
Multichannel fast analyzer	S+
Automated dispensing machinery for drugs	S
Record locator system	S
Training Developments	
Job descriptions, experience requirements, screening tests, and career ladders	S+
Curriculum content	S+
Standing orders and guidelines	S+
Management training for physicians	S+
Problem-oriented record	S+
Building Systems and Planning Process Developments	
Compatibility of VA system with DOD needs	S
DOD building system	L
Planning units and project summaries	S+
Extension of RELATE program	S
Long-Term Reconsiderations	
Reconsideration of discarded concepts	L
Evaluation Committee	
Evaluation of innovations in prototype hospital	L

Legend

S Short term development (less than 18 months)
S+ Short-term but continuing development
L Long term development (18 months to five years)

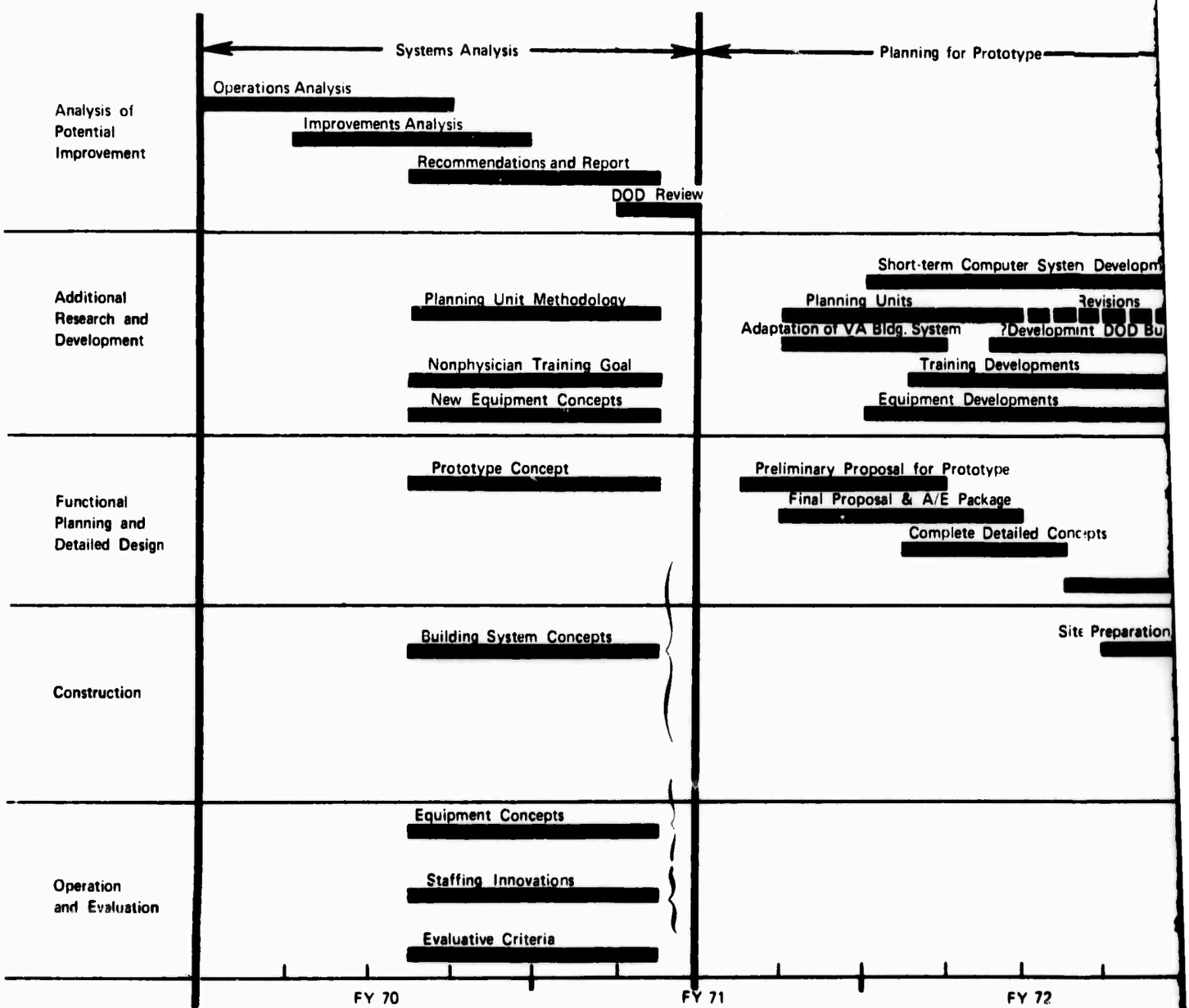
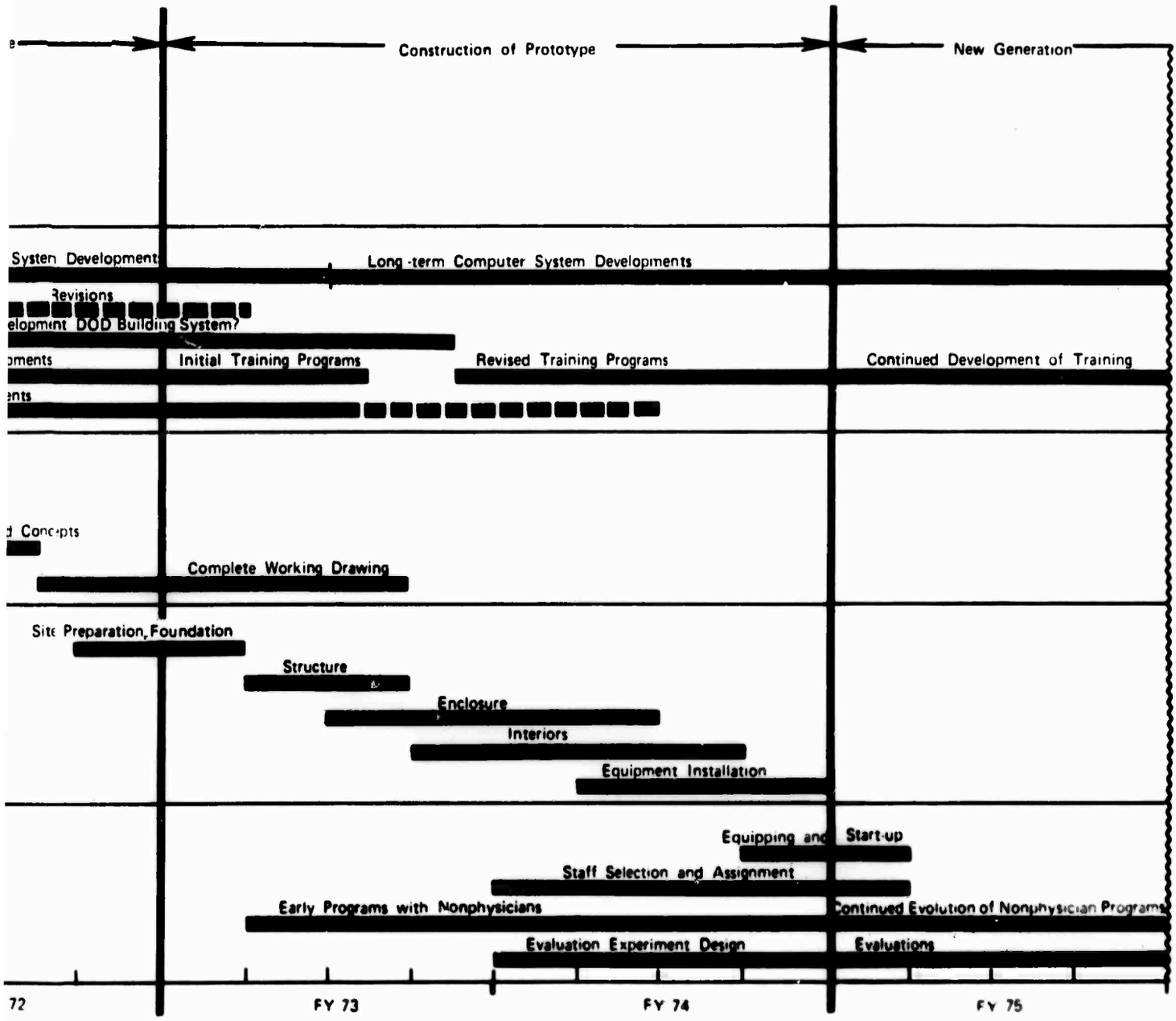


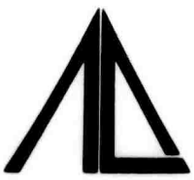
FIGURE 8.1 SCHEDULE FOR DEVELOPMENT OF 'NEW GENE

A



ENT OF "NEW GENERATION" MILITARY HOSPITALS

B



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