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## An Admissions Scheduling Program

Robert G. Dunn\* and James T. Howell\*

*With the support of the professional staff, and the use of operations research techniques and the computer (IBM 360, Model 30) at the Henry Ford Hospital, the systems planning and development section of the administrative staff has been able to apply research data to the immediate problem of assigning hospital beds. This brief report describes purposes and results. Interested readers are referred to a more comprehensive analysis of the system available in reprint form.*

Research in the methods of providing health services is being sought at this time to develop more effective medical programs for the American public. Unfortunately, there are few researchers in this field and no established methods for investigation. Engineers and economists interested in medical affairs are joining doctors and administrators in an attempt to produce an expertise in health care research. Thus far, most of the effort for such research is being centered in the hospital, choosing it as a convenient point where services and facilities are employed in rendering care to patients. Some of the research is concerned with work improvement; some with technical medical subjects; some with storage and retrieval of information (frequently paper work handling), but some is concerned with the management of the medical care system itself.

At Henry Ford Hospital, our health care research is concerned with the management of the total system. After having studied the objectives of the staff and the hospital as concerns the provision of continued high quality of medical care and the responsibility of rendering that care within an economic framework that the patient can readily afford, it is clear that both the high quality of patient care and the cost of service should include medical educational and research activities. The satisfactions of the patient and the physician are both vital to the success of rendering health services. As these thoughts are mobilized, the capability of coordinating effectively the efforts of physicians and the utilization of the institutional facilities becomes the important component to study in the evolution of an operational model and ultimately a system which can be reproduced and further evaluated for the medical profession.

\*Administration, Henry Ford Hospital. Special thanks are paid to Dr. Joseph L. Ponka and Dr. Carl Hammerstrom for their assistance in this project.

As tools for development of studies in the delivery of health services, operations research methods, systems engineering and analytical models are to be used which will require logic diagramming and computer programming. Basic to the construction of a system which can be demonstrated to be effective as well as economical is the need to schedule the utilization of important facilities of which the hospital bed becomes the important initial determinant in the chain of events which is to follow in patient care.

A review of the methods employed at the Henry Ford Hospital beginning with the request of a physician for a bed for a patient until the arrival of the patient in that bed is evidence of the highly complex nature of this transaction. (Figure 1.) This is particularly so within a medical staff that is fully specialized, receiving patients with a broad spectrum of medical problems including a high frequency of very serious medical conditions. A review of our admitting procedures indicated that there are questions and information which must enter appropriately the scheme to bring about dependable scheduling.

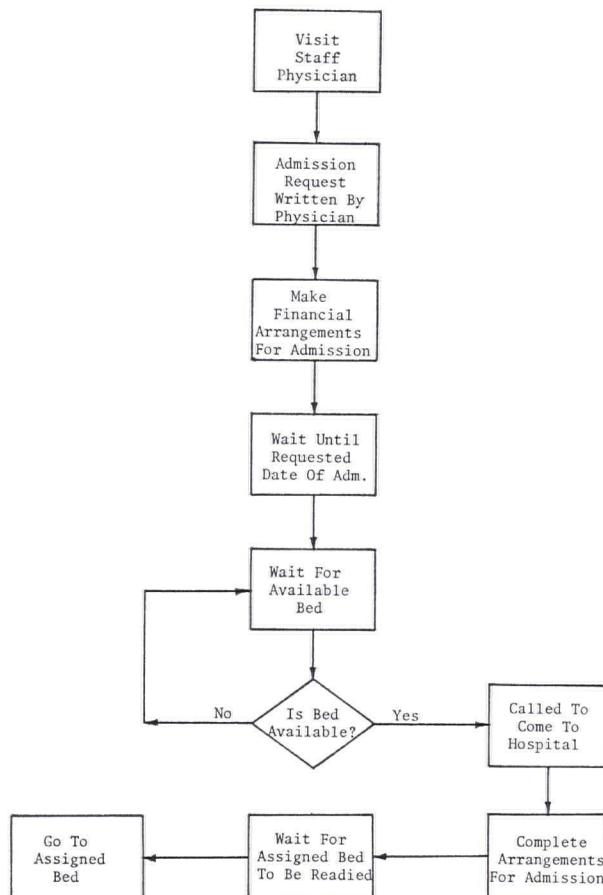


Figure 1  
Steps to be completed by patient for admission to hospital.

## **An Admissions Scheduling Program**

Over three years of data were systematically collected and analyzed to predict available beds on specified days of the week, weeks of the months and months of the year. As one may suspect each day is variable, but has a pattern which we are able to predict within acceptable ranges. To be sure, it was necessary to evaluate emergency admission rates, death rates, and discharge data. The study was conducted on adult beds excepting obstetrical beds. As soon as a repetitive daily pattern could be defined, determinations were made of the number of available beds that could be declared reasonably sure (reserved beds) and the number of other beds (standby beds) that could become available under usual conditions. It is possible to schedule the reserved beds a number of days in advance as well as a portion of the standby beds. Three or four days in advance of predicted admissions, the discharge rates are reviewed and a new value for standby beds is determined. This technique is employed daily, thereby assuring the availability of beds for urgent admissions.

One can quickly appreciate the need for reliability in the information supplied by the requesting physician such as the preferable date of admission, degree of medical urgency, estimated length of stay, gradation of complexity of the case, extent of laboratory and x-ray procedures, the date of operation, the admitting diagnosis and the operative procedure to be performed. That excellent cooperation has been received from the medical staff is an understatement for the results are suggested by the reduction of backlogged cases to reasonable levels during the busiest months of the year and even to zero at times. Further study will be necessary for validation that these methods of scheduling result in increasing physician and patient satisfaction and improving the utilization of valuable facilities which are fundamental purposes for establishing the project. The data for predicting available beds are shown in figures 2a and 2b and computer routines are shown in figures 3 and 4.

Now that a degree of proficiency exists (one year of operation) other routines may be added. These will be future subjects for research as soon as we can improve techniques for measuring medical management phenomena, remembering that the goals are those of maintaining the high quality of care while controlling the expense to patients. The effort underway at this time is to develop a patient selection program which will result in admitting the right patient for the right doctor on the proper hospital floor and utilizing diagnostic and therapeutic facilities with increased proficiency. Accomplishing these objectives will tend to stabilize the practice and educational patient load as well as the professional and paramedical complement necessary for each physician's medical service.

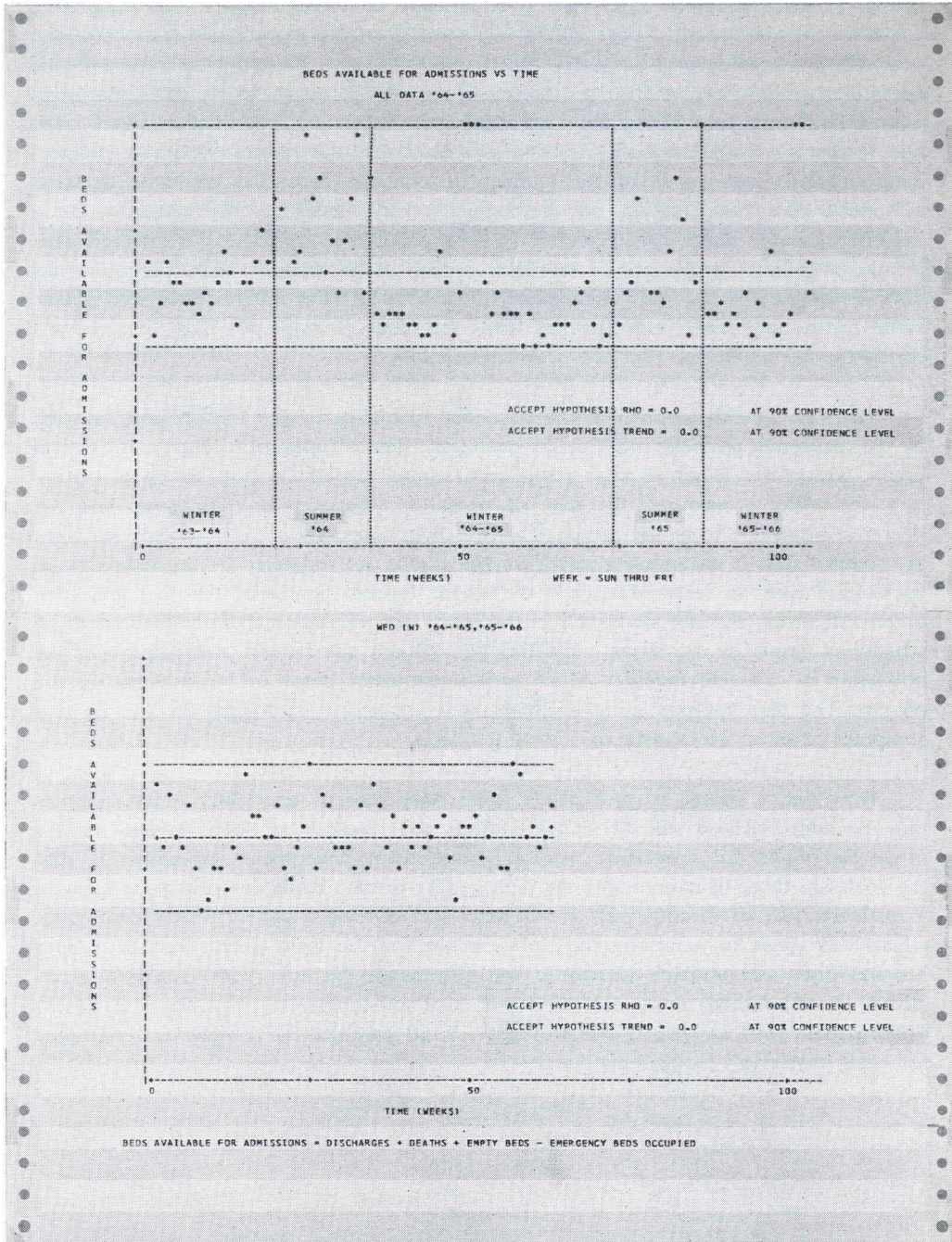


Figure 2a and 2b

Studies like this were made for each day of the week (a.: Wednesday) and for the seasons (b.).

## An Admissions Scheduling Program

**SCHEDULING ADMISSION REQUESTS**  
**PROGRAM FLOW**

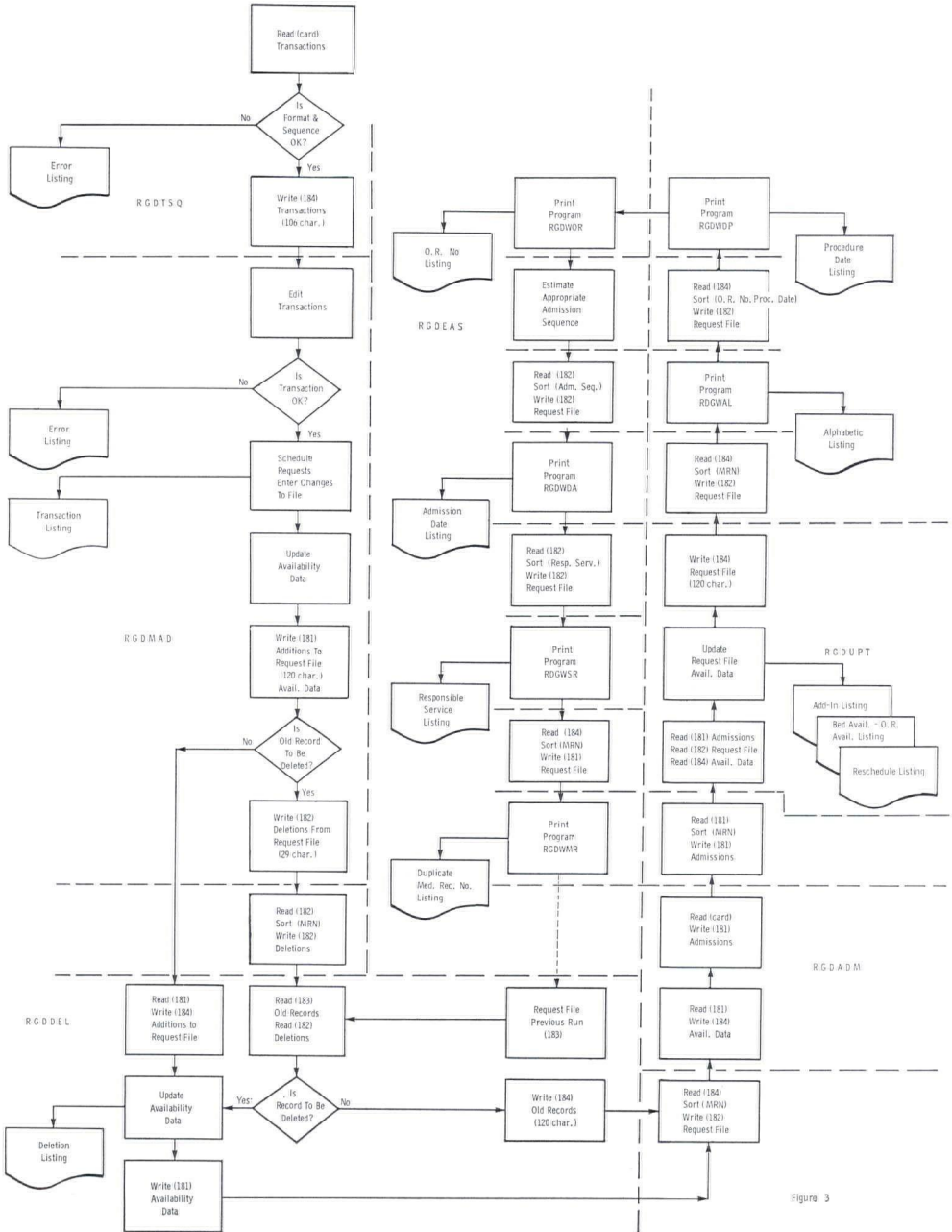


Figure 3  
Scheduling admission requests program flow.

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TRANSACTIONS																	
RUN 2 ON 102567																	
PATIENT'S NAME	MEDICAL REC NO AGE SEX ADM	TYPE REQ	DATE ADM	DATE PROC	PROCEDURE	RESP PHY	DUAL HRS	OPER COMP	EST STAY	RED REG	RED PREV	RED ASSG	RED DATE	RED DATE	RED DATE	RED DATE	RED DATE
10203963 76 F	UR-3	1024	1025	0	POST RAD HASTECTOMY	PICK	0.0	2	14	SEMI NEW	0	0					
ASSIGNED A SURGICAL STAND-BY REQ ON 1025																	
13015703 66 F	UR-7	1024	1025	0	VENT ANEURYSM	PICK	0.0	1	7	SEMI NEW	0	0					
ASSIGNED A MEDICAL STAND-BY REQ ON 1025																	

REDS AVAILABLE FOR ADMISSION REQUESTS																	
AFTER RUN 2 ON 102567																	
DATE	RESERVE	SURGICAL STAND-BY	RESERVE	MEDICAL STAND-BY	PRODIATRIC	TOTAL REDS SCHEDULED		BACK LOG									
1025	0	14	1	22	27	43		8									
1026	16	0	5	22	24	38		9									
1027	27	5	0	41	30	22		0									

OPERATING ROOM TIME AVAILABLE FOR SURGICAL PROCEDURE REQUESTS																	
AFTER RUN 2 ON 102567																	
DATE	1A-1B	2A-2B	3A-3B	4A-4B	5A-5B	6A-6B	7A-7B	8A-8B	9A-9B	K-3	K-9	ALTC	PRDCC	TOTAL HRS SCHEDULED			
1026	9.50	4.50	9.50	11.50	13.00	16.00	6.50	16.00	14.50	22.00	4.25	6.50	6.50	98.75			
1027	16.00	10.00	16.00	7.50	16.00	12.50	13.00	12.50	15.00	23.00	6.50	6.00	9.00	26.00			
1028	10.50	16.00	10.00	9.50	18.00	16.00	16.00	13.00	16.00	22.50	7.00	3.50	8.00	25.00			

ALPHABETIC LISTING																	
SCHEDULED ADMISSION REQUESTS																	
102567																	
PATIENT'S NAME	MEDICAL REC NO AGE SEX ADM	TYPE REQ	DATE ADM	DATE PROC	PROCEDURE	RESP SERV	DUAL RM	OPER HRS	EST CPX	RED STAY	RED REG	RED ASSG	RED DATE	RED DATE	RED DATE	RED DATE	RED DATE
12977555 68 F	ELC	918			CHECK UP	MC 1			1	3	PREV	W-AU	1001				
7730393 54 M	ELC	1016	1112		CHECK UP	MC 5			1	5	PREV	R-ST					

SCHEDULED SURGICAL PROCEDURES																	
102567																	
FOR SURGERY ON 1026																	
PATIENT'S NAME	MEDICAL REC NO AGE SEX ADM	TYPE REQ	DATE ADM	DATE PROC	PROCEDURE	RESP SERV	DUAL RM	OPER HRS	EST CPX	RED STAY	RED REG	RED ASSG	RED DATE	RED DATE	RED DATE	RED DATE	RED DATE
5909128 63 F	ELC	1023	1025	1026	EXC VULVAR LESION	GYN		1	0.5	1	7	SEMI		0	0		
6021084 57 F	HR-3	1016	1025	1026	BIOPSY TUMOR BREAST	GYN		1	1.0	1	7	SEMI		0	0		

SCHEDULED SURGICAL PROCEDURES																	
102567																	
OPERATING ROOM 2 ON 1026																	
PATIENT'S NAME	MEDICAL REC NO AGE SEX ADM	TYPE REQ	DATE ADM	DATE PROC	PROCEDURE	RESP SERV	DUAL RM	OPER HRS	EST CPX	RED STAY	RED REG	RED ASSG	RED DATE	RED DATE	RED DATE	RED DATE	RED DATE
6476495 16 M	ELC	919	1025	1026	EXC POSS WAVE DIGIT P1 5			2	1.0	1	7	SEMI		1017	NUO	0	
9871343 33 M	ELC	1021	1025	1026	CLOSURE PISTULA	URDL		2	1.0	1	7	SEMI		0			

SCHEDULED ADMISSION REQUESTS																	
102567																	
FOR ADMISSION ON 102567																	
PATIENT'S NAME	MEDICAL REC NO AGE SEX ADM	TYPE REQ	DATE ADM	DATE PROC	PROCEDURE	RESP SERV	RESP PHY	OPER RM	EST HRS	RED CPX	RED STAY	RED REG	RED ASSG	RED DATE	RED DATE	RED DATE	RED DATE
8021084 57 F	UR-3	1016	1025	1026	BIOPSY TUMOR BREAST	GYN	EGNA		1	1.0	1	7	SEMI	S-AL	0	0	
448606 60 M	ELC	929	1025	1026	VAG HYST & REF	GYN	STEV		1	2.0	2	14	SEMI	S-AL	0	0	

SCHEDULED ADMISSION REQUESTS																	
102567																	
CARD																	
PATIENT'S NAME	MEDICAL REC NO AGE SEX ADM	TYPE REQ	DATE ADM	DATE PROC	PROCEDURE	RESP SERV	DUAL PHY	OPER RM	EST HRS	RED CPX	RED STAY	RED REG	RED ASSG	RED DATE	RED DATE	RED DATE	RED DATE
33010226 20 F	UR-7	1016	1025		O LYMPHEDEN RT LEG	SCHA			0.0	1	7	WARD	R-ST	1024	NUO	0	
13028174 58 M	UR-7	1023	1025		O R H O	HEN			0.0	1	5	SEMI	S-ST		0	0	

Figure 4 Composite sampling of computer sheets.

The above analytical work is the product of the systems planning and development section of our administrative staff and is described more fully in the journal, *Health Services Research*, volume 2, number 2, pages 181-216.