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Physician and Patient Behavior  
under Different Scheduling Systems  
in a Hospital Outpatient Department

by

John F. Rockart  
and  
Paul B. Hofmann

July 1969

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## ABSTRACT

Most research in the field of ambulatory patient scheduling has defined outpatient appointment systems along a patient arrival spacing dimension. Along this dimension, scheduling methods have been described which range from pure block systems (in which all patients are asked to arrive before the start of the clinic) to individual appointment time systems (in which patients are given appointments at intervals which approximate average physician service time). The results of these systems, both actual and hypothetical, have been probed in depth by researchers. Four factors--the type of scheduling system utilized, the amount of physician lateness, the amount of patient lateness, and the patient no-show rate--have been shown to strongly affect patient waiting time.

A study performed in the Combined Clinics of the Massachusetts General Hospital and the Massachusetts Eye and Ear Infirmary provides two additional findings with regard to the ambulatory scheduling process. First, it was noted that the assignment at the time of appointment of a patient to a specific physician is another significant element in the design and the effectiveness of appointment systems. Second, with the addition of the assignment variable in system definition, a striking behavior pattern was found. The no-show rate, patient arrival time, physician arrival time, and patient waiting time were all seen to change



During the past two decades, a steadily increasing amount of literature, both theoretical and pragmatic, has dealt with the need to improve the administrative treatment of the hospital outpatient. Most of the work in this area has been centered on the extent and cause of the lengthy wait endured by patients prior to seeing a physician. Although the methods utilized in these studies have varied considerably, their conclusions have been remarkably consistent.

Starting with the Nuffield Studies in 1952,<sup>6</sup> reports have focused on four factors affecting the amount of waiting endured by patients. Most emphasis has been placed on the spacing of patient appointments throughout the clinic session. Working only along this "spacing dimension," researchers have observed and/or developed many different appointment systems. However, the varying types of systems discussed have been defined on this dimension alone. In general, it has been found that as one moves on the spacing vector from a "pure block" appointment system, wherein all patients report at the beginning of the clinic session, to an "individual" appointment time system, in which patients are spaced equally throughout the clinic period, patient waiting time is reduced.

The other principal factors which have been shown to significantly affect waiting time are physician lateness and two aspects of patient arrival patterns. Physician lateness, as would be expected, translates



in concert from one appointment system to another among three major systems studied. All factors were found to be more favorable to the expeditious delivery of patient care in systems which treated the patient more as an individual in comparison with those that implicitly regarded the patient as an anonymous figure seeing an unidentified physician.





directly into increased patient waiting. Patient behavior, specifically lateness and non-arrival for appointments, has been shown to affect the patient's delay prior to seeing the physician and to have a substantial impact upon the optimal design of scheduling systems.

A recent study performed in the Combined Clinics of the Massachusetts General Hospital and the Massachusetts Eye and Ear Infirmary supports these general conclusions. Two additional findings with regard to the ambulatory scheduling process are described here, however. These are:

1. A second dimension was found to be pertinent in the definition of appointment systems. It was found that systems had to be categorized both with respect to (a) the spacing dimension and (b) whether or not patients were assigned to a particular physician at the time the appointment was made.
2. With appointment systems redefined in this manner, an interesting behavior pattern was seen to exist. Both physicians and patients tended to act "more responsibly" with regard to arrival patterns in those clinics whose systems increasingly recognized the patient as an individual.

The data behind both of these findings will be presented after a brief review of previous work in the field.

#### Previous Studies

The techniques utilized in previous studies have differed widely. The original Nuffield study observed the delays incurred by patients in many of Great Britain's outpatient centers and found an average patient waiting time per appointment of 56 minutes.<sup>7</sup> Welch and Bailey,<sup>12,1</sup> using non-computer Monte Carlo methods on this data, pointed out that



extensive patient waiting was due to block scheduling and provided theoretical results which illustrated the superiority of individual appointment time systems. They suggested that patients be scheduled according to the average physician service time.

A dozen years later, White and Pike constructed a mathematical model taking into account patient punctuality, a factor which had not been considered by Welch and Bailey. When patients are punctual, White and Pike suggested that an appointment scheme be used in which two or three patients are called at the start of the clinic session and the others are called at a rate which approximates the doctor's mean consultation time.<sup>13</sup> When patients tend not to be punctual, they recommended that small blocks of three patients each be scheduled to arrive at time intervals which are three times the average consultation period.

Other mathematical models have been utilized to resolve the problem as illustrated by the work of Soriano.<sup>9,10</sup> Working at the Wilmer Ophthalmological Institute at Johns Hopkins, Soriano experimented with various types of patient scheduling systems along the spacing dimension. He modeled the pure block appointment system and the individual appointment time system. He also tested a "mixed block" system of appointments (similar to White and Pike's), which reduced the size of the initial block and spread patient arrival times throughout the session. In addition, he evaluated the effects of "two-at-a-time" arrivals at intervals that were twice the length of the average consultation time. Patient waiting time behaved as expected in each case, being less in Soriano's interim systems





than in the one block system and more in the interim systems than in the individual appointment time system.

Using computer simulation, Fetter and Thompson<sup>2</sup> also modeled ambulatory scheduling in 1965. Seven variables were considered. These were appointment interval, service time, patient arrival pattern, no-shows, walk-ins, lateness of physicians, and interruptions in service by the physicians. The simulation illustrated that, as might be expected, increased waiting time was caused by an increased number of patients scheduled for a clinic session. In addition, the dramatic increase in patient waiting time as a result of doctor tardiness was substantiated. Finally, Fetter and Thompson demonstrated the adverse effect of patient unpunctuality on waiting time.

Experiments with actual operating systems have also been reported. Working at Hennepin County General Hospital, Villegas<sup>11</sup> experimented with small variable blocks to allow for patient non-arrival tendencies. Again, the effectiveness of individual appointment time systems and the detrimental effect of physician tardiness was emphasized. Most recently, Johnson and Rosenfeld have concluded, in an observational study of patient waiting times in New York City hospitals, that there is "a powerful rationale for more individualized appointment systems in preference to conventional block systems."<sup>3</sup>

In most of these studies, the authors naturally have been concerned with doctor idle time. In general, this factor has been found to increase as patient waiting time decreases. Observations in this area vary



considerably from study to study for reasons which we will discuss at some length later in this paper.

### Method of Study

The Combined Clinics of the Massachusetts General Hospital and the Massachusetts Eye and Ear Infirmary received a total of 237,000 patient visits during the fiscal year 1967-1968. Appointment procedures in the 62 separate clinics vary considerably and include almost every conceivable system.

An initial study of the various appointment scheduling methods disclosed four major systems based on two attributes: the "spacing dimension" and the "assignment" of a specific doctor to the patient. As shown by Figure 1, the four systems in common use can be illustrated as combinations of these two factors. Along the horizontal is shown the two endpoints of the spacing dimension, the pure block system and the individual appointment time system. Vertically, the figure shows whether the patient is scheduled merely to see the first doctor who becomes available during the clinic session (not assigned) or whether he is "assigned," at the time the appointment is scheduled, to be seen by a particular physician (who is, in most cases, his continuing physician in the particular specialty clinic). It should be noted that a few clinics do not do any scheduling at all and thus do not fall into any of these four classifications. In these clinics physicians see patients primarily on a walk-in basis. They are mostly small clinics, and are not significant in terms of the numbers of patients seen.



A comparative study of all four systems was clearly desirable, but close screening of the actual operation of the various systems eliminated the individual-assigned system from consideration. In every case where such a system was reported as being used in a major clinic, it was found that the system was actually being carried out by administrative personnel in a manner which could not be construed as a true individual-assigned appointment system. As a result, data were collected only on the three other systems (which are left unshaded in Figure 1).

The clinics to be studied were chosen from among the major clinics utilizing the remaining three systems. Each clinic in the sample was observed for several sessions. Differences in the patient sample sizes reflect the relative numbers of clinics using each system (only five are individual unassigned) as well as differences in the numbers of patients scheduled per clinic session.

### Findings

Data were collected on patient arrival time, the patient no-show rate, physician arrival time, patient waiting time, and physician idle time. Interestingly, as one moves from top to bottom and then from left to right (i.e., from block unassigned to block assigned to individual unassigned) among the systems shown in Figure 1, the previously mentioned improvement in both patient and physician behavior toward a more efficiently functioning scheduling system is clearly noted. The study findings are discussed below with regard to each of the observed variables.





Patient Arrival Time. Table 1 illustrates the mean arrival time for patients attending the clinics under each of the three systems.\* The tendency for the patients who have greater specificity of appointments (either an assigned doctor or an individual appointment time) to arrive earlier is clearly demonstrated.

The "patient unpunctuality" argument against providing individual appointment times is especially undermined by these data. It appears that when a patient is given a specific time to be seen he responds to this more individualized treatment by altering his behavior to arrive more promptly for his appointment. Perhaps equally important, those patients who have figured out how to "beat" the pure unassigned block system with regard to waiting time (by arriving late<sup>\*\*</sup>) are forced to modify their arrival behavior toward promptness in an assigned block system. If they arrive too late, their physician, having seen all other patients assigned to him, may already have left.

The No-Show Rate. The no-show rates also varied in the same manner among the three systems as shown in Table 2. Particularly notable is the sharp drop in the no-show rate from the block systems to the individual system. Outpatient department statistics were also available (in this area alone) for all clinics under each system for

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\*There is a fairly large standard deviation for each system, but results are still significant by an F-test at the 5 percent level.

\*\*Our data, as well as those of others, illustrates that late arrivals under an unassigned block system have a lower average wait than patients who are prompt.



a complete year. These statistics provided the same ordering of systems with regard to the no-show rate as our sample; with figures of 26 percent, 23 percent and 16 percent for the block unassigned, block assigned and individual unassigned clinics, respectively. The differences are significant at the .01 level.

In their 1968 article, Johnson and Rosenfeld suggest that attention "could profitably be given...to mechanisms for reducing premature and tardy arrivals of patients as well as failure of patients to keep appointments, since these introduce into the logical process an erratic factor that, if excessive, can defeat the aims of the appointment system."<sup>4</sup> Based on the evidence on patient lateness and no-shows presented above, it is apparent that the system itself (especially an individual appointment system) can be an important "mechanism" for affecting the patient arrival and no-show tendencies in the directions desired.

Physician Lateness. Just over 100 physicians attended the clinics under study during the survey. They accounted for 244 physician-arrivals which ranged from fifty-two minutes early to three hours late. Seventeen physician-arrivals were more than one hour late, with a large concentration of these in the block unassigned clinics. As a result, as Table 3 shows, physician arrival performance in the block unassigned system is distinctly worse than in the other appointment systems. The distributions of arrivals for each system cluster closely enough so that the differences are significant at the one percent level.

Patient Waiting Time. One would expect from the previous work cited



that, all other things being equal, patient waiting time would follow the pattern set by physician lateness. As Table 4 shows, this is the case. In describing patient waiting time, two distinct measures have been utilized by other researchers. "Total waiting time" describes the time the patient spends waiting from the moment of his arrival until the time he is seen. "True" waiting time, a more applicable figure when the objective is to determine the inconvenience to the patient, is defined as the delay between the scheduled appointment time or time of arrival, whichever is latest, and the actual start of the visit with the physician. Table 4 illustrates true waiting time, and shows appointment system differences which are significant at the one percent level.

Of all the patients seen, 55 percent waited more than one hour to see a physician. More than 17 percent of the block unassigned patients waited more than two hours. On the other end of the scale, only four percent of the individual unassigned patients endured a two hour wait.

Physician Idle Time. Contrary to expectations, physician idle time was not observed to vary much between systems. Under each system, idle time was less than four percent, with the lower idle times (two to three percent) as anticipated, incurred by the block systems. However, the measurement of idle time is very difficult. Physician behavior appears to reflect Parkinson's Law, and where schedules are light or large numbers of patients are not accumulating, physicians take longer with each patient. This tends to eliminate much of the idle time which might build up otherwise. The reverse phenomenon, of physicians hurrying when faced



with large patient waiting queues, is also true.<sup>8</sup>

### The Assignment Variable

The above data demonstrate significant differences between the pure block system clinics when they are further subdivided based on the assignment variable. Both physician and patient data suggest that block-unassigned and block-assigned clinic patients belong to two discernibly different groups with respect to the variables which were observed. It is important to distinguish between these two clinic forms and the scheduling behavior which they produce.

### A Behavioral Observation

Table 5 summarizes the first four variables and directly illustrates an important behavioral pattern. For the three systems observed, physician and patient actions all move in a desirable direction as increasing scheduling concern is shown for the patient's comfort and convenience.

The first two columns of this table demonstrate the previously researched conclusion that patient waiting time will increase with physician lateness. Taken in conjunction with the patient behavior shown in columns three and four, however, the physician lateness pattern in column two suggests an additional conclusion. As appointments become more personalized (in one case by the assignment of a patient to a particular physician, and in the second by the patient being given a specific appointment time) there is a tendency for both physician and patient to act more responsibly toward each other. The physician arrives more punctually and the patient not only





arrives on time, but also appears for his appointments more consistently.

In part, the findings on patient behavior can be explained from the viewpoint of simple self-interest. Many patients have learned that, under a block unassigned system, they wait less time by arriving late. As a consequence, this type of patient tends to inflate the average lateness in the block unassigned clinics. Patients with individual appointments, on the contrary, know that they are usually seen more nearly on time. Thus, they have a positive incentive to be punctual for their appointments.

The findings can also be interpreted, however, as evidence of more responsible behavior from patients in settings where they are treated more as respected individuals. There is support for this conclusion from the industrial setting. Likert among others has shown that where employees are treated more responsibly as human beings, they behave more responsibly (by increasing production, seeking more responsibility, etc.).<sup>5</sup> It can be suggested that the patient feels that he is being treated more as an individual when he is assigned to a particular physician. He therefore has a tendency to keep more appointments and to arrive more nearly on time. In those clinics in which the patient is given a specific time to be seen, it can be suggested that he feels a responsibility to utilize this individually allotted time. On the contrary, under an unassigned block system, the fact that he has been actually allocated a share of the clinic's resources for that day is much less obvious to the patient. His sense of responsibility, with regard to not arriving, and/or arriving at the time requested, is therefore much lower.



For the physician, much of the same interpretation applies. In a block assigned clinic, he knows that there is a certain subset of patients who are waiting specifically for him. Hence, his arrival time is important to a particular group of people whose waiting time is, to a large extent, dependent upon his--and only his--arrival time. The explanation for the decrease in physician lateness in the unassigned individual system is less clear, but the knowledge that patients expect to be seen at specific appointment times may provide an additional incentive for the physician.

It cannot, of course, be suggested on the basis of this data that a changeover of a particular clinic scheduling system from, for example, block-unassigned to individual-assigned, would automatically change the behavior of patients and physicians in that clinic. Most clinic personnel believe that the appointment system currently being utilized is best accommodated to the clinic's particular circumstances. (For example, block unassigned systems are most often found in clinics where scheduling decision-makers believe that external factors--such as physician operating schedules or patient attitudes toward the diseases treated by the clinic--dictate that physicians will be tardy and that patients will often not arrive or will be late). Just how important these external factors are, or how much they actually vary from clinic to clinic, is uncertain. The exact impact of a new system at a particular clinic must be carefully considered before a change in appointment system is performed.



Summary

The spacing dimension is not the only variable which should be considered in the definition of appointment systems. Whether or not a patient is assigned to a particular physician is also pertinent and was found to distinguish clinics with discernibly different characteristics with regard to several major variables. In addition, the data collected in this study showed that as an appointment system became more specific (with regard to both physician assignment and individual appointment times), there was a tendency for both physicians and patients to act more responsibly. In effect, more patient-oriented systems tended to produce behavior on the part of all participants which allowed clinic sessions to function more smoothly and thereby keep patient waiting time at a minimum.



Figure 1

Appointment System Matrix

Appointment Spacing

Physician Assigned?	Block	Individual
No	Block Unassigned	Individual Unassigned
Yes	Block Assigned	<del>Individual Assigned</del>





Table 1  
Patient Arrival Time by  
Type of Appointment System

<u>Appt. System Type</u>	<u>No. of Pts.</u>	<u>Pt. Mean Arrival Time (Mins.)</u>
Block Unassigned	259	9.7 late
Block Assigned	575	2.9 early
Individual Unassigned	80	14.1 early



Table 2

The No-Show Rate by Appointment System

	<u>#Pts.</u> *	<u>No-Show</u>	<u>%</u>
Block Unassigned	397	108	27.2
Block Assigned	998	224	22.4
Individual Unassigned	105	14	13.3

\* The differences between this Table and Table 1 are caused by cancellations.



Table 3

Physician Lateness by Appointment System

<u>Appointment System</u>	<u>Mean Lateness</u>
Block Unassigned	35.1 late
Block Assigned	9.4 late
Individual Unassigned	2.2 early



Table 4

True Waiting Time

<u>Type of Appointment System</u>	<u>No. of Patients</u>	<u>Mean Waiting Time</u>
Block Unassigned	259	85
Block Assigned	575	57
Individual Unassigned	80	33





Table 5

Summary Table

<u>System</u>	<u>Patient Mean Waiting Time (minutes)</u>	<u>Physician Mean Lateness (minutes)</u>	<u>Pt. Mean Arrival Time (minutes)</u>	<u>Pt. No-Show Rate (% of pts. scheduled)</u>
Block Unassigned	85	35.1 late	9.7 late	27.2
Block Assigned	57	9.4 late	2.9 early	22.4
Individual Unassigned	33	2.2 early	14.1 early	13.3



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Biographies

John F. Rockart, Ph.D., is an Assistant Professor in the Sloan School of Management at M.I.T. He holds an M.B.A. from Harvard and a Ph.D. from M.I.T. He spent several years with IBM working with computers in the medical field. His primary research at the present time is in the applications of computers to medical management.

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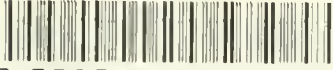
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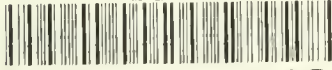
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