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ABSTRACT

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n extensive literature search revealed that the use of various types of appointment systems, the use of allied health personnel, and the use of triage, or the priority sorting of patients. are all major methods currently being used to improve patient flow in health care systems. In an effort to determine the effectiveness of the use of triage in improving patient flow in an outpatient clinic. the operation of the general practice clinic at the Williams AFB Hospital was studied. This is a small military facility which was using an impanelment system based on triage in parallel with an individual appointment system at the time of the study. Primarily through the use of patient questionnaires, the two systems were compared on the basis of provider service times, total service times, total number of patients seen, and patient satisfaction. A Results of the study showed that although triage patients had lower provider service times (8.55 min. vs. 12.45 min.), their total service times were significantly longer (68.3 min. vs. 37.5 min.). In addition, these long waiting times were shown to significantly affect patient satisfaction with the service at the clinic as a whole. Furthermore, it was discovered that the use of triage in this manner actually decreased the total number of patients seen in the clinic. However, it was proposed that by using medical technicians rather than physician assistants for screening, and by using modified wave reduced and the total number of patients seen could be increased without sacrificing the principle of triage.

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THE EFFECT OF TRIAGE ON PATIENT FLOW

IN AN OUTPATIENT CLINIC

by

John Wallace Koch

has been approved

December 1979

APPROVED:

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Supervisory Committee

ACCEPTED: Department Chairperson

Dean, College of Engineering and Applied Sciences

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CHAPTER 1 INTRODUCTION

With the increased use of hospital outpatient facilities for primary health care, crowded waiting rooms and long waiting times have come to be expected by the patients involved. Nevertheless, there has been a great deal of research done in the past, beginning with the work of N. T. J. Bailey and J. D. Welch for the Nuffield Hospitals Trust (6, 7, 77, 131), on various methods for improving patient flow through an outpatient clinic. Bailey's work centered primarily around the development of appointment systems, and a great deal of research has been done, and is still being done, in this area. However, there are also other more recent developments for improving both the availability of service and the speed with which it can be obtained. Two primary innovations are the use of allied health personnel to perform some of the duties formerly done only by physicians, and the use of triage. or the priority sorting of patients, to improve the overall flow of patients through an outpatient clinic. Although triage has been used mainly in emergency rooms or walk-in clinics, it has recently begun to be used as a tool for improving services at clinics run on an appointment basis as well. However, there has as yet been very little research done to determine the effectiveness of using triage in this manner.

Recently, a triage system was introduced for use in the general practice clinic of the small military hospital at Williams AFB. The system is run on an appointment basis, and officials at the hospital were interested in analyzing the effectiveness of the new system. Since the system is being used in parallel with a traditional appointment system, a study of the operation of this clinic afforded an excellent opportunity to compare the relative merits of the two systems.

In this report, general background information on the use of various appointment systems, the use of allied health personnel, and the use of triage will be provided. Following that, a more specific background will be given, explaining the operation of the clinic chosen for this study. The methodology to be used in obtaining data will then be discussed. Next, the results of the study will be presented, followed by recommendations for improving the operation of the clinic. Finally, the contribution of this research, as well as recommended areas for further research, will be discussed.

CHAPTER 2 GENERAL BACKGROUND

Because of ever increasing health care costs, health care administrators are continually trying to improve and streamline health care systems. Although their efforts cover the entire range of activities in these facilities, patient flow is one area that has received an especially great deal of attention. Rising has described patient flow as the problem of "...bringing together the...patient and the appropriate /health care/ providers within the proper environment (86:4)." The patient flow problem itself can be broken down into several aspects, including appointment systems, the use of allied health personnel, and triage. However, these areas all focus on one main goal: ensuring maximum utilization of the health care provider, while simultaneously minimizing inconvenience to the patient (86). This is particularly important in an outpatient setting.

Appointment Systems

Significant research on appointment systems has been conducted for over 25 years, beginning with the work of N. T. J. Bailey and J. D. Welch for the Nuffield Provincial Hospitals Trust (6, 7, 77, 131). At that time the most common appointment system in use was the simple block system. Since Bailey's work was done, a number of different types of appointment systems have evolved, including individual appointment systems, mixed block and individual systems, and more recently wave and modified wave systems. The block appointment system is, in practice, no appointment system at all. Mainly used in private practice years ago, the block system has become practically extinct. Ferhaps a description of the system can best explain the reasons for this. A doctor, or other provider, schedules certain hours when he will be available for consultation, for example 8:30 to 11:30 AM and 1:00 to 3:00 PM. Patients arrive at their convenience, and are seen on a first come, first served basis. Under this system, waiting times can build up rapidly, especially if patients begin arriving hours before the scheduled start of the day so that they can be at the beginning of the queue. Common traits of this system are extended waiting times and crowded waiting rooms, and these conditions eventually prompted the work done by Bailey and Welch (6, 7, 111).

Bailey was one of the first to develop an individual appointment system. In an individual appointment system, each patient is assigned a specific period of time during which he is to meet with the health care provider. From the provider's point of view, the most important benefit of this system is "...to supply a steady stream of patients so that the provider will not have to wait (86:33)." Just as important is the commitment to the patient "...to secure access to the provider at a convenient time with as little waiting as possible (86:33)." However, these benefits to the patient and provider result not only from the individual appointment system, but also from most other new systems as well. In determining the period of time to be assigned for each appointment, Bailey suggested using the average consultation time:

It is suggested that each doctor...should ascertain his average consultation time for each type of clinic he holds. In working this out he should include all time spent on consultation, examination, entering up case papers, etc.--in short, everything he does for the patients. He should exclude time taken up by casual interruptions (131:1108).

Use of average service time has since become a standard in the design of appointment systems.

Further efforts to improve appointment systems resulted in the development of a modified block system. Although it also is based on average consultation time, the modified block system applies this principle in a slightly different way. Rather than scheduling each patient for appointment intervals based on the average service time, a number of patients are scheduled for one appointment time, with the length of the appointment being equal to the total service time for the patients. For example, in a clinic with an average service time of 10 minutes, three patients could be scheduled to arrive at each 30 minute interval. The main objective of this system is to ensure that at least one of the patients is available at the scheduled time. and therefore it is used most commonly with two or three patients scheduled for one appointment time. Its effectiveness has been demonstrated by Soriano, who has shown that a two-at-a-time system can reduce waiting times over an individual appointment system by as much as 50% (111:397).

Wave and modified wave systems are a more recent development, and have shown some promise in decreasing waiting times as well as increasing productivity. The basic idea behind these systems is to modify the streams of incoming patients so as to have peaks and

valleys, or "waves," in the schedule, allowing the physicians occasional opportunities to catch up and therefore finish the day approximately on time. Consequently, the main feature of these systems is the method used for scheduling patient arrivals:

> The actual schedule is based on the approximate number of patients a physician can see in an hour's time on the average, how many actual examining rooms are available to the physician, and the importance of not scheduling any patient after the 30- to 40minute point of the hour. An example would be the schedule of a physician who, on the average, sees approximately five patients an hour and has one examining room available. The first two patients are scheduled on the hour, the third and fourth for 15 minutes after, and the last on the halfhour (134:31-32).

Under this system, the best results are achieved when the more minor illnesses can be scheduled at the beginning of the hour. Although this technique has shown promise in improving patient flow and increasing productivity, it has failed to be widely implemented. As Lane, Schroer, and Willis have all explained, this is most probably due to a failure of physicians to either understand or to properly implement the system, rather than to the structure of the system itself (56, 98, 134).

Although these appointment systems appear in theory to provide for the orderly and efficient flow of patients through the health care system, in reality a number of problems are inevitably associated with all of them. Early or late arrivals, walk-ins, or broken appointments can turn what seemed to be an orderly appointment system into complete chaos. If left unchecked, the system may disintegrate to the point where there is really no system at all. Because patients will not

arrive at precisely their scheduled appointment time, because they may arrive without any appointment at all, and because they will require varying amounts of time and various levels of provider skills for their care, these factors must be considered in the design of an effective appointment system.

Although late arrivals can increase patient waiting time. studies have shown that patients tend to arrive ahead of their scheduled appointment time (77, 100, 131). If these patients are seen at their scheduled time, the only problem arising from the early arrival is that of the increased waiting time which is induced by the patient himself. Health care providers must be careful, however, not to routinely service early arrivals ahead of their scheduled time, especially if they are taken before patients with earlier appointments. This can increase the waiting time for other patients, as well as teach the patient bad habits. One reason appointment systems fail to work as designed is because patients are allowed to circumvent the system. This can occur when patients are not taken in order of their appointment times, as in the case of early or late arrivals. It can also occur if walk-ins are seen ahead of patients who have scheduled appointments, or even if walk-ins are seen in spite of clinic policy which requires every patient to have an appointment. However, these problems can be overcome by actively encouraging patients to be punctual, and by making allowances for walk-in patients.

In dealing with the problem of providing care for walk-in patients or for patients with urgent problems, administrators and others working in these systems need to recognize that, logically,

"Systems that accept walk-in patients and emergencies are inherently more variable, and therefore tend to be less efficient than systems that will accept patients only by appointment (86:7)." Two methods which have been recommended for use in alleviating this problem are the use of a work-in rate in designing a clinic schedule, and the use of an urgent appointment system (14, 134). When using the work-in rate, a number of appointment blocks are not scheduled, based on the expected number of walk-in patients each day. In a similar fashion, appointment blocks are also kept open each day under an urgent appointment system, but these appointments are filled ahead of time on a same day basis. The advantages of the urgent system over the work-in rate are obvious. By scheduling specific appointment times, urgent patients are worked into the appointment system in an orderly fashion, with a much smaller degree of variability in the number of patients that need to be seen on a same day basis.

As mentioned earlier, another problem that can destroy an otherwise orderly appointment system is patients who fail to show up for their appointments. Numerous studies have been done on broken appointments and appointment breakers, on topics ranging from what type of patient tends to break appointments and why, to various methods which can be used to reduce broken appointment rates. These studies have shown broken appointment rates ranging from highs of 11% to 42% being reduced to minimums of from 7% to 9%, primarily through the use of mailed or telephone reminders (3, 4, 20, 30, 36, 37, 50, 51, 58, 65, 74, 85, 97, 102, 105, 106, 119).

One further aspect of appointment systems, as they relate to

the patient flow problem, should be mentioned. A number of studies have been done on the use of centralized vs. decentralized appointment systems (19, 53, 68, 80, 108, 120). When patients use hospital or other outpatient facilities that have more than one clinic or health care provider, making an appointment with the appropriate provider can become a problem. A number of calls, to various providers or clinics, may be required before the patient has secured an appointment with the provider best able to care for him, in terms of professional knowledge and skills, availability, and patient desires. Another problem can result if a patient needs appointments on the same day with more than one provider. X-rays and a physician for example. In this case numerous calls. scheduling and rescheduling appointments, may be necessary before an acceptable combination of appointments is achieved. By using a centralized appointment system, many of these problems can be eliminated. In a centralized system, appointment sheets for all health care providers are located in a single area. Appointments are made, in most cases by telephone only, by contacting the appointments area and asking for services needed. The appointments clerk can then determine the appointment availability of the various providers, as well as sequence appointments for the various providers. Because of these advantages, centralized appointment systems seem to be used almost universally at large health care facilities.

Allied Health Personnel

As a result of recent efforts to help improve patient flow and to increase physician productivity, the use of allied health

personnel has become increasingly widespread. A major reason for this, as Johnson has stated, is that "The productivity goal of the individual physician should be to utilize the skills that are unique to medicine at their maximum levels for the greatest amount of time consistent with high-quality performance (47:82)." He further indicates that physician productivity can be increased through the use of efficient scheduling procedures and by relieving them from nonprofessional duties. The use of allied health personnel is seen as a major means of more fully utilizing the unique skills of the physician. In addition, another widespread method of relieving physicians from nonprofessional duties is through the use of medical technicians. Although these two professions are related from the standpoint of relieving physicians from certain duties, there is a difference in the types of duties performed by each.

Medical technicians are employed primarily for the purpose of taking vital signs, such as temperature, blood pressure, and respiration, and for assuming other minor duties so that the physician's time can be spent in consulting and examining the patient. Although some specialized training is required, it is relatively minor compared to that of physicians or allied health personnel.

There are a number of titles given to the various types of allied health personnel, and although their degree of training and basic responsibilities are similar, they can be used in a variety of ways. Whether called paramedics, nurse practitioners, nurse clinicians, physician extenders, physician assistants, or MEDEX personnel, their main purpose is to perform duties formerly done only

by physicians, so that more people can be seen safely and efficiently.

The types of duties performed by allied health personnel are numerous, and with widespread acceptance by both physicians and patients, they are continually expanding their capabilities. Generally they are trained for specific areas of responsibility, as pediatric or obstetric nurse practitioners for example, but they can also be used in a general practice setting for the treatment of minor illnesses. In most cases allied health personnel are found in clinics and physicians' offices, working alongside and with easy access to physicians. However, they can be used as independent providers of care. One example of this is the use of paramedics in an outreach program in Peoria, Illinois. This program is considered successful, and has shown a high degree of acceptance by both physicians and the community (76). When working in clinics and physicians' offices. allied health personnel assume a great deal of the workload of the physician. Properly trained personnel can competently treat a great variety of problems with no degradation in the care received by the patient, thus increasing the time the physician can spend treating problems that require his particular expertise.

A large number of studies have been done to determine the effectiveness of allied health personnel both in the treatment of patients and in increasing physician productivity, and also to determine their acceptance by patients and physicians (16, 24, 27, 29, 32, 54, 59, 60, 61, 62, 63, 66, 69, 71, 75, 99, 107, 112, 114, 115, 118, 126, 127). Spector reports that nurse clinicians were effective in providing high quality health care during an evaluation of an

internal medicine clinic (114). Spitzer came to the same conclusion in a study of nurse practitioners used in a family practice (115), as did Vickery in an evaluation of the AMOSIST program used by the US Army (126). In a more quantitative study, Sox reported that in one clinic a computer audit of patient records revealed that 45% of the patients treated in the clinic could have been correctly treated by physician's assistants (112). In another study Komaroff also examined the use of physician assistants (54). Data analysis showed an 11% false positive rate, that is, patients being referred to a physician when they could have been properly cared for by the physician assistant, and a 1% false negative rate, or patients who were not referred to a physician when they should have been. Other results indicated that 37% of the cases were handled without seeing a physician, and that in 94% of the cases handled by the assistants, physicians accepted their diagnosis.

The use of allied health personnel can also increase physician productivity. For example, Garfield reports that in a paramedically staffed health-care-delivery system, improvements were shown in physician accessibility, waiting time for new appointments, and physician time and costs per entry work-up (29). Similarly, Glenn also reports that productivity can be increased through the use of allied health personnel (32). In a study done at the Jamestown Medical Clinic in Virginia, Voltmann examined productivity increases through the use of nurse-practitioners (127). Physicians there were able to shift from 50% to 75% of their tasks to the nurse-practitioners.

In other studies done on the use of allied health

personnel. it has been shown to be widely accepted by both physicians and patients. Merenstein reports a high degree of acceptance of the nurse practitioner by the families who used her in a family practice (71). In another study of a family practice, Spitzer also reports high satisfaction with the nurse practitioner by both patients and professional personnel (115). Steinwachs explains that because of the care received and the general acceptance of health practitioners, the staffing mix of a group practice changed from primarily physicians to a majority of health practitioners over a three year period (118). Initial feedback from Vickery's evaluation of the AMOSIST program also indicates patient acceptance of the system (126). In addition, Day has found that 94% of the patients who used a pediatrician working with a pediatric nurse practitioner were satisfied with the care they received. And finally, Linn reports that patients showed greater satisfaction with the care they received from family nurse practitioners than with that received from traditional providers in four out of five areas (66).

As has been shown by these examples, the use of allied health personnel in all phases of health care can increase physician productivity, and is a rapidly expanding answer to the problem of improved patient flow.

Triage

Another relatively new principle for improved patient flow in an outpatient setting is the use of a triage agent, or an impanelment concept. Triage is the process of assigning priorities,

in terms of time and of provider, to patients who are seeking medical care. The term "triage" originated on the battlefield, where personnel needed to develop a system to determine which patient should be seen first at military field hospitals faced with mass casualties. Although this process has since evolved to use in many other settings besides the life and death situation in which it originated, the basic process involved has remained fundamentally unchanged. Briefly, this process involves a priority sorting of patients. The most serious patients are scheduled to be seen ahead of those who have relatively minor problems, and in some applications, a further decision is made as to which provider the patient should see to receive his care (125).

There are a number of elements involved in implementing triage systems in order to improve patient flow. As Slay has stated, "To be effective, a triage system must be rapid, medically sound, uniform in its disposition, and make dispositions in accordance with the qualitative and quantitative medical and surgical resources available (109:875)." Careful consideration must be given to the medical qualifications of the triage agent, the resources available to the agent, and the setting in which triage is used.

Various studies have been conducted to determine the effectiveness of a variety of triage agents (1, 17, 70, 73, 95, 109), and the medical skills of the triage agents have ranged from those of a receptionist to those of a physician. Slay maintains that effective triage can be performed by personnel with no previous medical experience, by using an algorithm-directed triage system (109).

Furthermore, Donald M. Vickery, in working on Project AMOS at Ft. Belvoir, Virginia, has developed an excellent algorithm-directed system (125). Mechaber reports that licensed practical nurses at the Rochester Neighborhood Health Center have shown excellent judgment in directing patients to proper areas for medical care, and have generally been effective as triage agents (70). Similarly, reporting on a study conducted at the Kings County Hospital Center in New York, Russo found that in a comparison of the performance of pediatricians and nurse practitioners, the evaluations agreed 84% of the time. This shows that a considerable savings in physician time could be realized by the use of pediatric nurse practitioners as triage agents (95). In other studies done using specially trained nurses as triage agents, Mills reported an overall triage accuracy of 98% (73), and Albin found a 3% mistriage rate (or 97% accuracy) at the Bronx Municipal Hospital Center (1). Finally, DeAngilis conducted a more comprehensive study, involving comparisons of pediatricians, pediatric nurse practitioners, registered nurses, and receptionists as triage agents. Although physicians and nurse practitioners were found to be best, registered nurses and receptionists were also safe and were thought to be more cost-effective in certain settings (17).

In considering the resources that should be available to the triage agent, Vickery recommends that a physician and physician's assistant should be available to the triage agent at all times. Here he uses the term physician's assistant to indicate either a physician's assistant, nurse practitioner, Medex, or any other type of assistant with similar training. In addition, he recommends that the physician

be a generalist, competent to handle a wide variety of problems, and mentions that referrals to specialists would more properly be made by the physician rather than by the triage agent (125).

A review of the literature has shown that by far the most common and effective uses of triage occur in outpatient settings for patients arriving without appointments, usually in emergency rooms (1, 73, 94, 109, 125, 128, 129, 130). In all of these studies, triage systems used in emergency departments resulted in more efficient operations and the increased productivity of health care providers. Since one aspect of triage is the screening of patients which results in some cases with non-urgent conditions being scheduled for care at a later date, Weinerman reports that the emergency room load at the Grace-New Haven Community Hospital was reduced 20% after the institution of a triage system (130). Once again it is obvious that triage is also an effective method for improving patient flow in a health care delivery system. It is this principle of triage that will serve as the main focus of this report.

CHAPTER 3 SPECIFIC BACKGROUND

Triage, or the priority sorting of patients, is currently gaining in acceptance and utilization in health care delivery systems. Although, as stated previously, the primary area of use has been in emergency rooms, other areas of outpatient care are beginning to adopt this method. One example of this is the general practice clinic of the USAF Hospital located at Williams AFB, Arizona.

The Williams AFB hospital is a small military hospital which provides inpatient and outpatient care to active duty and retired military personnel and their dependents. Inpatient capabilities include a 33 bed medical/surgical ward, and an 8 bed OB/GYN ward. Outpatient care is provided by a number of clinics, primarily general practice, OB/GYN, pediatrics, and flight medicine. There are approximately 10,000 patients seen each month in the various clinics.

Prior to the implementation of the panel, or triage, system, the general practice clinic operated under an individual appointment system. (See Appendix 1) Appointments were scheduled for fifteen minute intervals beginning at 8:15 AM. The last appointment in the morning was scheduled for 11:45 AM. Appointments began again at 1:00 PM, with the last appointment scheduled for 4:15 PM. With allowances for a morning coffee break and afternoon rounds, providers were available for service for 26 fifteen minute appointment slots during a normal day. Of these 26 appointment slots, a certain number were reserved for patients with acute problems, to be filled on a same day basis only. In addition to these, military sick call was held during the first part of the morning. Appointments were not scheduled for this period, but rather each provider was available to see active duty military on a walk-in basis. Prior to the implementation of impanelment, however, military sick call was eliminated because the demand for those slots was not as great as the availability. Active duty military were then seen through the use of urgent appointment slots which were reserved specifically for their use.

Under the old system as well as under the present system, all appointments for the general practice clinic are made through a central appointments clerk. Access to the clerk is by telephone only. This is done either by calling the clerk from outside of the hospital or by using a direct line telephone in the hospital. The appointment desk opens at 7:00 AM. This method of access is quite common, and is recommended by Rising in order to provide for faster service and to train patients to telephone for appointments in advance (86).

The general practice clinic itself is situated in an easily accessible area of the hospital. The staff consists of seven health care providers: three physicians, three physician assistants, and one nurse practitioner. There are also five medical technicians. These medical technicians are normally the first point of contact for the arriving patient. The technician sitting at the reception desk logs the patient's arrival on the clinic's appointment sheet and makes the initial entry in the patient's medical records. The patient is then directed to either the appropriate waiting area for the provider he will be seeing, or to the screening area if the taking of vital signs



is indicated. In the screening area, another medical technician will take the vital signs and then direct the patient to the appropriate waiting area.

Providers are notified of a patient's arrival when the technician places the patient's medical records in an in-basket located in the waiting area. After seeing a patient, the provider returns the records to the reception desk, and then checks his inbasket to call his next patient. If lab tests or X-rays are indicated and the patient is to wait for the results and then return them to the provider, the patient will keep his records and then return them to the reception desk along with the completed lab work. The records will then again be placed in the appropriate in-basket so that the patient can once more be seen by the same provider.

During a recent staff assistance inspection of the hospital, one of the findings was that the appointment system used by the general practice clinic was inadequate. It was felt that the waiting period for routine appointments was too long (usually about two weeks), that more people could be seen each day, and that the number of same day or urgent appointments could be expanded. In an effort to make these improvements, an impanelment system, based primarily on Vickery's work (125), was instituted in the general practice clinic. Long range plans call for total integration of the impanelment system, but for the period of this study the individual appointment system is being used along with impanelment.

Currently, a panel consists of four members. Two members of the panel perform the triage, or screening function, and the remaining

FIGURE 2

TRIAGE PATIENT FLOW

USAF HOSPITAL WILLIAMS AFB



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and the second of the

two care for the patients. One physician and one physician assistant are assigned to patient care. Another physician assistant and a medical technician perform the screening function. It should be noted that in this instance, the term physician assistant includes the nurse practitioner. The technicians are included in the screening process to gain experience and training, in preparation for the expansion of the impanelment system, when, according to plan, they will perform some screening functions independently.

When the panel was first instituted in the clinic, a combination of modified block and individual appointment systems was used. (See Appendices 1 and 2) Patients were first given an appointment with the screener. These appointments were scheduled for three blocks in the morning (eight at 8:30 AM, six at 9:30 AM, and five at 9:45 AM), and two blocks in the afternoon (eight at 12:45 PM and nine at 1:45 PM). Subsequent individual appointments at ten minute intervals for physician assistants and twenty minute intervals for physicians were then scheduled by the screener. After an initial evaluation period, a few changes were made in the panel schedule. Patients are currently scheduled for screening during five blocks in the morning (four each at 8:30 AM, 8:45 AM, and 9:30 AM, three at 9:45 AM, and seven at 10:30 AM) and four blocks in the afternoon (four each at 1:00 PM, 1:30 PM, and 2:00 PM, and five at 2:30 PM). The screener assigns patients to the care of either a physician or physician assistant, and they are then seen as soon as possible by the health care provider on a priority basis according to the severity of their illness.

The remaining providers in the clinic continue to see patients on an individual appointment basis. The providers rotate duties and are scheduled on the panel for one week at a time. If patients need a follow up visit, they can be scheduled for the same provider they saw initially by calling for an appointment through the appointments desk. They can then arrange for the appointment during the following week or whenever the next appointment with that provider is available. Should it be necessary for the follow up appointment to be within a definite time period, three days after the initial appointment for example, and there is either no appointment available or the provider will be on the panel that day, provisions have been made so that the patient can still see the original provider. If the provider is not scheduled for the panel, but does not have an appointment available, he can personally call the appointments desk and schedule the patient for one of the reserved urgent appointment slots. This can be done by any of the providers in the clinic, to insure that they will be able to follow up on their own patients. If the provider will be on the panel. the patient can be scheduled for one of a limited number of individual appointments included in the schedule. The first two morning appointment slots for the three providers serving on the panel are scheduled on an individual basis. In addition, the first two in the afternoon for the physician and physician assistant who are treating the patients are also available on an individual basis. The screener does not have this option in the afternoon since screening begins at 1:00 PM, immediately after the lunch hour.

There is no special area set aside for use exclusively by the

panel. Providers assigned to the panel use their regular offices and examining rooms for screening as well as treatment.

All providers are expected to be in the clinic by 8:00 in the morning. Since this is a small facility, providers working in this clinic can also admit patients for inpatient care. Normally, in a larger facility, admissions are handled by specialists. Because of this, except for providers working on the panel, the first 15 minutes of the day are blocked off for rounds, as is one 15 minute period in the afternoon. Depending upon the provider, this is at either 4:00 PM or 4:15 PM.

Based upon this understanding of the two parallel systems being used and the requirements of the clinic and facility implementing them, it will now be possible to objectively evaluate and compare the new system to the old. Thus the objectives of this study are as follows: to analyze the two different appointment systems now in use, to compare these two systems, and then to make recommendations that would improve patient flow in this clinic.

CHAPTER 4

RESEARCH METHODOLOGY

Objectives

Simply stated, the primary objective of this research is to analyze and compare patient flow. Because of time and resource limitations, this study will be restricted to the general practice clinic at the Williams AFB Hospital. The main focus will be on the new impanelment system.

As mentioned earlier, impanelment promises to be a successful method for improving patient flow. A number of clinics have shown definite improvements in many aspects of patient flow after an impanelment or triage system has been instituted. Specific areas of improvement have included the number of patients seen, waiting time, appointment availability, and the routing of patients to the providers best able to care for them. Because impanelment is being implemented in this case in order to improve upon the service previously provided by an individual appointment system, the crux of this research will be a comparison of the two systems. However, the study is planned to include a number of areas.

The major area of analysis will be the impanelment system. It is hoped that enough definitive information on the system will be obtained to reach significant conclusions on its effectiveness. Data will be collected on a number of different aspects, including the number of patients seen each day, patient waiting time, the time of completion of care for the last patient of each period (morning or afternoon), and patient satisfaction with the system. Since the individual appointment system is being operated in parallel with impanelment, a simultaneous study based upon the same criteria will also be made on this system.

Based upon the data collected, these two systems will then be compared in an effort to determine the effectiveness of impanelment in improving patient flow. In addition, patient satisfaction with the two systems will also be compared. After determining which system, if either, is superior in terms of overall performance, recommendations will be made for further improvements.

Scope

Because this is a small facility, the general practice clinic serves as a scheduling and reception base not only for the primary health care personnel described earlier, but also for a small number of specialists as well. Although a small part of the duties of the medical technicians consists in the support of these specialists, they do not affect the operations of the other areas of the clinic and will not be studied.

Improved patient flow and provider productivity could be realized by a number of improvements besides impanelment. For example, one improvement which could be made would be to increase the number of providers to create greater appointment availability. Similarly, improved service and waiting times could also be realized through the use of multiple examining rooms for each provider. This topic was discussed during informal interviews with these providers, and it was
felt that generally a great deal of service time is wasted in waiting for the patient to dress or undress. Multiple examining rooms would allow the provider to work with a second patient while waiting for the first one to dress, which naturally would result in increased efficiency in terms of patient flow and physician utilization.

There are also a number of other improvements that might possibly be made in the area of physical capabilities. None of these really need to be discussed, however, for the following reasons. In the first place, the hospital is considered to be fully staffed, and Air Force manning policy strongly discourages overstaffing. And secondly, the hospital utilizes all available areas for patient care, and there are no additional areas which could be used to improve the physical facilities available for use by the general practice clinic. Because of these and other factors, the following are to be considered constants for the purposes of this study: the number of examination rooms and providers offices, the number of physicians, physician assistants, and medical technicians assigned to the clinic, and the appointment personnel and appointment making procedures.

Falling under the jurisdiction of the Air Training Command (ATC), the USAF Hospital at Williams AFB is also responsible for following the rules and guidelines of that command. Included among these is a letter from Brigadier General Wesp, the ATC Command Surgeon, outlining guidelines for the evaluation and operation of outpatient clinics (132). These guidelines will be considered in the evaluations and recommendations made in this study and are discussed more fully in Chapter 6.

Anticipated Results

Prior to conducting the formal survey, tentative expectations regarding the operation of the general practice clinic had been developed. These preconceived ideas were based not only upon a thorough review of the pertinent literature, but also upon personal knowledge and experience in obtaining service from this and other similar clinics. Among the attributes expected were: mean provider service times of less than 15 minutes; mean total service times of less than 45 minutes; shorter provider service times for the patients seen by the panel than for those seen on an individual appointment basis; slightly, but not significantly, longer total service times for impanelment patients; and, on the average, patients arriving early for their appointments. A no-show rate of 10% at most, but probably much less, was also anticipated.

Personal experience has shown that consultation times for most problems tend to range from five to ten minutes. In support of this estimate, Jackson reports a mean consultation time for general practitioners of 4.55 minutes (45). However, the Nuffield Study inicates that the average consultation time in general practice clinics is 8.7 minutes for established patients (based upon 561 observations), and 25.2 minutes for new patients (131 observations). The overall consultation time for this group averages 11.82 minutes. Furthermore, the mean consultation time for a number of specialty clinics along with the general practice clinic was found to be 13.57 minutes (based upon 5618 observation) (77). But in contrast, Soriano reports mean consultation times of 20.1 minutes (111).

Since large numbers of patients in the waiting area of the clinic, indicating average service times longer than appointment intervals, were never observed, and because of the majority of the various studies showing average consultation times of less than fifteen minutes, it seemed most likely that consultation times in the general practice clinic would also average less than fifteen minutes.

As used here, total service time is defined as the total time between the patient's arrival at the clinic and the time he completes service with the provider. It does not include time spent at the pharmacy, labs, or other areas, unless the patient is to wait for results and then return to the provider for further consultation or examination. The expectation that the mean total service time would be under 45 minutes was also based primarily on the results of the Nuffield Study (77). This study surveyed approximately 12,500 outpatients at 60 hospitals and found that the overall mean waiting time for patients, from their appointment time until seeing the doctor, was 25 minutes. Combined with the overall average service time of approximately 14 minutes, and an average arrival time of 6 minutes early, the average total service time of the patients surveyed for the Nuffield Study was 45 minutes.

Another related finding of the Nuffield Study was that clinics started seeing patients an average of 12 minutes late. Investigating this, it was found that "If a clinic starts late, the delay is normally perpetuated throughout the whole course of the clinic and the waiting times of virtually all the patients are increased (77)." The report concluded that this wait averaged at least two-thirds of the

time that the doctor was late in starting his clinic. Similar conclusions were also reached by Fetter and Welch in their independent studies (21, 131). Based primarily upon personal experience, it was felt that providers in a military facility would tend to be more punctual than their civilian counterparts. If all other factors were comparable, it was assumed that the general practice clinic could therefore improve upon the 45 minute total service time shown in the Nuffield Study.

The opinions of the providers working in the clinic weighed heavily in making the assumption that provider service times would be shorter for the patients seen by the panel than for those seen on an individual appointment basis. It was generally felt that an acute minor illness could be treated much more rapidly than chronic problems. For example, the treatment for a bad cold is fairly standardized and requires little time for diagnosis, whereas a patient with a chronic back pain could have any number of problems, requiring a variety of treatments and considerable time for proper diagnosis. Since triage is designed for patients who feel that they need to be seen on a same day basis, it seemed most probable that the majority of them would have some type of acute minor illness. Conversely, it was also felt that the majority of patients with chronic problems would schedule themselves for routine appointments. Commenting on a similar situation, Rising states that "Research has also shown that service times are longer, on the average, for appointment visits than for walk-in visits (86:24)." Following the same logic, this would be true because the majority of the walk-in visits would be for acute minor

problems, while the majority of appointment visits would be for chronic problems.

The slightly longer total service times for impanelment patients would stem from a few of the differences between the systems. Because of the differences in treating acute vs. chronic problems, the average provider service time would probably be at least five minutes shorter, but most likely not more than ten minutes shorter, for impanelment patients. However, because of the necessity of first seeing a screener and then the appropriate provider, and because block arrivals would cause slightly increased waiting times, an additional fifteen to twenty minutes would probably be added to the total service time. Therefore, taking both of these factors into account, it was felt that the actual total service time for impanelment patients would be about ten to fifteen minutes longer than the total service time for patients with individual appointments. Lacking definitive studies to back up these estimates, they are based instead upon the opinion of clinic personnel and upon personal estimates of the times involved.

Because of the results of the Nuffield Study, indicating average patient arrival times of six minutes early, it was felt that patients in the general practice clinic would tend to arrive earlier than their scheduled appointment time. This determination of average early arrivals substantiated similar findings by Welch in an earlier study for the Nuffield Hospitals Trust (131). Schwartzman, at a much later date, also found that patients in a physical therapy clinic averaged an arrival time of two minutes prior to the appointment

time (100). These results tended to confirm personal habits and prejudices, and led to the expectation of early arrival times.

Finally, as reported previously, the minimum no-show rate in a number of clinics ranged from about 7% to 9%. In talking with the administrators of this hospital prior to the study, it was found that there was no accurate knowledge or determination of the no-show rate for the hospital. The administrators felt that it might be 1% to 2%, but that whatever it was, it was certainly not a problem. Based upon this, the expectation of a no-show rate of no worse than 10% developed. If a rate of 10% or less were found, this would be considered acceptable, and would not be an area in which improvements need be made.

Method

After deciding which aspects of the two systems to compare, and after determining what results would be most probable, the next step in the research process was to decide how best to gather the data necessary to make the comparison. Although a number of reference works were consulted, the method used for data collection was suggested mainly by two recent works by Rising and Stamps (86, 116). Primary data was obtained through the use of two questionnaires. The medical technicians at the reception desk were asked to hand the questionnaires to the patients when they arrived at the clinic and then to collect them when they had completed their visit.

Questionnaire A (See Table 1) was designed primarily to determine service times. The medical technicians were asked to circle

TABLE 1

QUESTIONNAIRE A: INFORMATION AND PURPOSE

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Question No.	Information Requested	Purpose(s)
1	Last four SSAN	Correlating data
2	Clinic arrival time	Early or late arrival Total service time
3	Time appointment made	Appointment availability
4	Time same-day appointment made	Appointment availability
5	Follow-up appointment	Appointment availability
6	Time of screening	Waiting times
7	Start and end of provider service	Provider service time Total service time
8	Lab tests	Percentage of lab tests ordered by screener
9	Lab tests	Percentage of lab tests ordered by provider
	Second provider start and end of service	Provider service time Total service time
10	Referral to doctor by PA	Mis-triage rate
	Start and end of service	Provider service time Total service time

P or A on the top of the questionnaire to indicate whether the patient was seeing the panel (P) or had an individual appointment (A). Patients were asked to answer ten questions pertaining to the service they received that day. The first question asked for the last four numbers of the sponsor's Social Security Account Number (SSAN). The sponsor is either an active duty military member or a retired military member, and his "last four" is consistently used as a standard means of identification for him and all of his dependents. This information was requested for use in correlating questionnaire data with data collected from other sources, mainly from clinic appointment logs. Question two asked for the time of arrival at the clinic. This was needed in order to compute service and waiting times. Questions three, four, and five asked for information on when the appointment was made, and also whether or not it was a follow-up appointment. The purpose in gathering this information was to try to determine appointment availability. Question six asked for the time the patient was seen by the screener in order to determine waiting times before the initial triage encounter for impanelment patients. Questions seven through ten asked for information concerning the type of provider seen, provider service times. and patient flow through the clinic. It was hoped that these questions would provide information concerning lab tests ordered by the screener prior to service by the provider, as well as provider service times and waiting times. In addition, question ten was also designed to help in the determination of mis-triage rates, by indicating patients who were first sent to the physician assistant when they should have been sent directly to the physician.

Rising suggests a variety of methods for obtaining this type of information. The simplest method suggested was the one that was used in the Nuffield Study (77). Using this method, providers are asked to record the amount of time spent each day doing tasks unrelated to patient service, such as lunch, coffee breaks, personal telephone calls, and so forth. At the end of the period of study (three days is recommended), these times are subtracted from the total time the provider spent in the clinic, and then the difference is divided by the total number of patients seen to compute the average service time. In contrast, the most complex method was to give each person a card when he entered the hospital. A time-stamp machine would be positioned at each service station the patient could possibly visit, and in and out times would be stamped on the patient's card each time he visited a station. It was hoped that Questionnaire A would provide more accurate and specific information than the first method, without the need for elaborate and unavailable equipment as required by the second method.

Questionnaire B (See Table 2) was designed to ascertain patient satisfaction with the service received at the hospital. The medical technicians were again asked to circle a P or an A, indicating the type of appointment, in an effort to make a comparative analysis of the two systems. Question one asked the type of provider seen by the patient. This information was needed in order to see if there was any difference in the patient's degree of satisfaction between the care received from the various types of provider. Questions two and three asked about the patient's waiting time, in order to determine whether

TABLE 2

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QUESTIONNAIRE B: INFORMATION AND PURPOSE

Qı	estion No.	Information Requested	Purpose(s)
	1	Type of provider seen	Type of provider seen
	2	Waiting time	Waiting time
	3	Reaction to waiting time	Patient satisfaction with waiting time
	4	Ratings of various aspects of services and personnel in clinic	Patient satisfaction
	5	Most liked aspect of hospital	General comments
	6	Least liked aspect of hospital	General comments
	7	Suggestions for improvement	General comments

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waiting times affected the patient's satisfaction with the system as a whole. Question four asked for subjective ratings of excellent, good, average, fair, or poor on seven areas of the clinic's operation. These areas included general evaluations of service and the appointment system, as well as evaluations of the staff. Questions five, six, and seven requested open-ended evaluation of the hospital. Although it was hoped to discover certain areas which were consistently considered to be either good or bad by the patients, the main purpose of these last three questions was to provide patient comments for the hospital administrators rather than to be the basis of any major finding of this report. Questions four through seven were based on suggestions given by Stamps for measuring patient satisfaction (116).

In the course of the development of the questionnaires, a number of revisions were made. It was felt that the simpler the questionnaire, the more cooperative patients would be in completing it. To accomplish this, the original design was to have each questionnaire fit on one half of a standard sheet of paper, assuming that a smaller questionnaire would appear less formidable to the patients. Sample questionnaires were then distributed to some fellow students and to several patients in the general practice clinic, and they were asked for a critique of the questionnaire, especially in terms of understanding the questions. The students found all the questions easy to understand, with the exception of one which asked the patient whether or not he had been seen by the panel. It seemed obvious that the patients would know whether or not they were being seen by the panel, but when the questionnaires were distributed to

several patients, it was apparent that they too wondered what a panel was. Consequently, this question was dropped from the final questionnaires, and the system of having the technicians mark a P or an A was substituted. The only other major change that was made was in the layout of the questionnaires. Although the questionnaires could each be fit on a half sheet of paper, they appeared quite crowded. By spacing the same number of questions onto an entire sheet of paper, a much more appealing and simpler format was achieved.

Additional data was gathered from existing records kept at the hospital. The main source for this information was the appointment logs kept at the clinic. At the start of the clinic day, one copy of the appointment log for each provider is sent to the reception desk in the clinic. Since the appointment desk opens earlier than the clinic. some of the urgent and panel appointment slots are already booked. Urgent and panel appointments filled after this time are recorded in central appointments, and then the information is telephoned to the clinic so that it can be recorded on the clinic's logs. As patients arrive, they are checked off on the logs by the medical technicians. No-shows and cancellations are also noted. In addition to this, each provider on the panel keeps a log of the patients he has seen. This information can then be matched against the master log for the panel in order to determine the number of patients sent to each type of provider, and also the number that were seen only by the screener, primarily for prescription refills, or told to make an appointment at a later date. The appointment logs were especially important in determining the number of patients seen by the providers and the no-

show rate, and in matching scheduled appointment times with questionnaires through the use of the "last four." The scheduled appointment time was not included as part of the questionnaire in an effort to keep it as concise as possible, but in retrospect, it should have been included for ease of data analysis.

A primary concern in developing the data collection methods was to minimize inconvenience and interruptions to the providers. Therefore, most of the data collection procedures excluded any need for their participation. However, in order to determine the times for first patient seen each period and completion of service for the last patient, it was felt that the easiest and most accurate method would be to ask the providers. To accomplish this, a simple form for use in recording this information was distributed to each provider prior to beginning data collection.

FIGURE 3

START AND END OF SERVICE FORM

		MON.	TUES.	WED.	THUR.	FRI.
Time first patient seen	AM					
	PM					
Time last patient leaves	AM					
	PM					}

In an attempt to determine the accuracy of the questionnaire data, the operation of the clinic was observed for two full days. Arrival times, provider service times, the type of provider assigned to triage patients, and departure times were recorded. By comparing the average service times obtained in this manner with those obtained from the questionnaires, it was hoped that the accuracy of the patient responses would be validated. The degree of accuracy would also be helpful in determining the optimum length of the data collection period. Initially, a two week period was planned, with an option to terminate after one week if the data was felt to be accurate and sufficient. Based on results from the Nuffield Study, Rising recommends only a three day period for data collection (86). It was felt that a two week period would be much more than sufficient.

Finally, the last step in data collection was to informally interview the physician and screener assigned to the panel during the period of the study, in order to determine their feelings about the acceptance of triage and about how well it was working. Also discussed were the procedures used for screening and suggestions for improvements. During the course of the study, the hospital administrator, the registrar, and the chief appointments clerk were also consulted.

TABLE 3

OBSERVED VS. QUESTIONNAIRE DATA

	Observed		Questionnaire	
Provider service time	n 204	x 11.55	n x 143 12.98	
Total service time	210	40.38	145 44.08	

CHAPTER 5 RESULTS

General Observations

Based upon the literature survey conducted prior to this study, several facets of the operation of an outpatient clinic appear to be current standards for efficient operation. Although not the primary objective of this study, a number of comparisons can be made between these general standards and the operations of the Williams AFB Hospital. These suggested standards include the use of an adequate appointment system, the use of physician assistants, and the use of triage.

The appointment system in use is, in most cases, an individual appointment system, and the use of 15 minute intervals for appointments seems to indicate the use of average service time as a basis for the system. By reserving a number of urgent appointments to be scheduled on a same day basis, an attempt is being made to see patients whose problems must be handled quickly. This compares favorably with the standards suggested by the literature. Indeed, a bare minimum for efficient appointment systems appears to be appointments based upon mean service time as suggested by Bailey (7), but including some sort of provision for walk-ins or urgent problems.

Another widely recommended standard for efficient operation is the use of a centralized appointment system. Such a system is in use at this hospital. As would be expected in the operation of a manual appointment system such as this, access to the appointments clerk is strictly by telephone. Again, this compares favorably with the standards gleaned from the literature.

Another aspect of operations which is highly recommended is the use of physician assistants or allied health personnel. Fitterer has stated that "...the Physician Assistants have become the backbone of military ambulatory patient care in military installations (24: 951)." The Williams AFB general practice clinic is no exception to this rule. The staff includes three physician assistants, one nurse practitioner, and three physicians, ample evidence that Fetterer's observation is true, in this case at least. As would be expected from a review of the literature, these physician assistants seem to be well accepted by both physicians and patients.

Triage, a relatively recent advance in improving patient flow, is also widely suggested as a means to efficient operation of hospital clinics, and is currently being used in the general practice clinic at this hospital. Although only recently implemented, the triage system appears to be running smoothly, as far as screeners and providers understanding and performing their duties satisfactorily. There is, however, a major difference between this and other triage systems reported in the literature, in that this system is being used primarily on an appointment basis, rather than as a means of handling walk-ins or emergencies.

Questionnaire Results

Perhaps inevitably, the questionnaires which were distributed did not yield quite as much useful information as was anticipated. Of

the approximately 500 questionnaires handed out, only 266, or about 50%, were returned. Most of these had some useful information on them, although a few of them were incorrectly or incompletely filled out. Probably the best way to review the effectiveness of the questionnaires, however, is to discuss them one question at a time, beginning with Questionnaire A (See Table 1).

For the most part, the medical technicians did remember to circle the P or A on the top part of the questionnaires prior to handing them to the patients, although they didn't always remember to pass out the questionnaires. The first question, the sponsor's "last four," was answered by almost all of the patients, although some people did leave it blank, probably to guarantee their anonymity. By matching this number with the number included for each patient on the appointment logs, it was possible to determine which provider saw the patient and what his appointment time was, since these questions had not been included on the questionnaire in an effort to keep it as simple as possible. However, because of the difficulty encountered in matching questionnaires to appointment logs, it is recommended that future questionnaires include a question on scheduled appointment time.

Questions two, six, seven, and nine, concerning arrival, departure, and service times, appear to have been answered fairly accurately, based upon a comparison of the mean service times obtained from the questionnaires and those obtained by personal observation, with one minor problem. For the most part, patients tended to round to the nearest five minutes. Despite this, it is felt that because of the large sample, the sample means are still representative of the

true means.

Questions three, four, and five asked for information on when the appointment was made, in an effort to determine appointment availability. Although these questions were generally answered accurately, the information requested was not really as useful as had been hoped. This is because the date when the appointment was made does not necessarily indicate the latest date that the appointment could have been made. However, judging by the number of same-day appointments, and by the fact that those calling in the morning almost always got morning appointments, these questions do seem to indicate that the system is working well as far as the availability of urgent appointments is concerned. Furthermore, a waiting period of approximately one week for routine appointments was determined through an informal interview with the chief appointments clerk. This compared favorably with the approximately ten days to two weeks waiting period prior to the implementation of the triage system.

A number of problems arose with the remaining questions, numbers six through ten. For one thing, as mentioned earlier, the patients tended to round off answers to the nearest five minutes. The main problem, however, lay in their understanding the questionnaire. A basic assumption made during the development of the questionnaire was that the triage patients would know when they were seeing the screener, as distinguished from when they were seeing the provider. This assumption seems to have been false, since the time given for question six was the same as the start time for question seven on several of the questionnaires. Many patients also failed to complete

this and other portions of the questionnaire, with questions nine and ten answered on less than 1% of them. It is impossible to determine whether this high degree of incompleteness is due to patients' simply failing to finish answering the questions, or whether it is an indication that only a very small number of patients were mis-triaged or asked to complete lab tests prior to being seen by the provider.

Because of the problems already discussed, the only useful information gained from Questionnaire A was the average total service times, the average provider service times, and the average arrival times as related to appointment times.

Questionnaire B (See Table 2) was answered more completely in most cases, probably because it was simpler. The first three questions were used in making comparative analyses of the answers to question four. By doing so, it was discovered that, among the variables, long waiting times have the greatest effect on the patient's attitude toward the clinic as a whole. Nevertheless, it should be noted that 76% of the patients answering this portion of the questionnaire felt favorably about the overall service at the hospital.

As mentioned previously, the last three questions of Questionnaire B were included mainly for use by clinic personnel. Although these answers were not tabulated because no trends were discernible, some interesting comments were received. Patients alternately liked and disliked the appointment system, the doctors, the medical technicians, and other aspects of the clinic. A number of people commented on the distance from their homes to the hospital, some liking it because it was close. and others disliking it because it

was too far away. One person liked "the friendliness of the staff," and another found that "once I see who I'm supposed to, they are very kind." Occasionally specific problems were mentioned, as the patient who was dissatisfied because "they won't fix my overbite." The survey itself even got one response--the patient liked it because that was "the first time I have not waited for 30 min.--1 hr. and watched the doctors going back and forth with their coffee and stopping to chat with fellow Dr. or nurses."

Major Findings

In analyzing the responses to Questionnaire A, it was found that the distribution of service times came from what appeared to be exponential rather than normal populations. In practice this means that there are a large number of short service times with a much smaller number of long service times. This result was expected, as Welch and Bailey had made the same observation (131). Because of this, the Mann-Whitney-Wilcoxon test (31:164-167, 192), as well as the student-t test, was used to determine whether the differences in the means computed was significant. (See Appendix 4) The Mann-Whitney-Wilcoxon test was chosen because it makes no assumptions about the underlying distributions, other than that they come from the same population. The student-t test was then used to reinforce the results of the Mann-Whitney-Wilcoxon test (138).

In all cases comparing mean service times, and also in comparing average differences in arrival time vs. appointment time, the following criteria were used. The null hypothesis, that the two sample means

were equal, was tested against the alternative hypothesis, that one was less than the other. P values of .10 or less were considered to be significant.

As expected, the provider service time for triage patients was less than that for appointment patients (8.55 min. vs. 12.45 min.). This difference was significant with P = .0013. However, since both means were less than the 15 minute period allowed for appointments, it is felt that either would be acceptable and that neither would account for excessively long service times.

There was a significant difference (P \lt .0002) between the two systems in total service times. While patients with regular appointments were in and out of the hospital in an average of 37.5 minutes, triage patients took an average of 68.3 minutes, or almost twice as long. Although a slightly longer time was expected, this difference is much greater than anticipated and must be considered a major drawback of the impanelment system.

A further area of study was patient arrival times. Again, there seems to be a significant difference (P = .0746) between the arrival habits of the two types of patients. Appointment patients tended to arrive an average of 12.7 minutes early, whereas triage patients arrived an average of 19.6 minutes early. This is probably due to the fact that triage patients are requested to pick up their records at the front desk before reporting to the general practice clinic. However, this difference is not large enough to account for the discrepancy in total service times. In fact, when this difference is combined with the difference in provider service time, the effect on total service time of 3 minutes is negligible. (See Table 4)

TABLE 4

THE EFFECT OF DIFFERENCES IN ARRIVAL TIMES AND PROVIDER SERVICE TIMES ON TOTAL SERVICE TIMES

	Panel	Appointment
Total Service Time	68.3 min.	37.5 min.
Difference	+30.8 min.	

Minutes Patients Arrive Early	19.6 min.	12.7 min.
Provider Service Time	8.55 min.	12.45 min.
Effect on Total Service Time	28.15 min.	25.15 min.
Difference	+3.0 min.	

Based strictly upon the master schedules, rather than upon actual performance, appointment availability was computed by using the average number of appointment slots that could theoretically be scheduled for each provider. (See Appendices 1 and 8) If the clinic were run entirely on an individual appointment basis, there would be an average of 84 urgent appointment slots available each day. Under the current triage system, an average of 87.2 urgent slots are

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available each day. However, to achieve this slight gain in urgent appointment availability, the total number of patients that can be seen each day has been drastically reduced. Under a pure appointment system, an average of 165.9 patients could be seen in the clinic each day. while under the impanelment system only 149.4, or 16.5 patients less. can be seen daily. In an effort to compare this theoretical loss with actual practice, the performance for two months, January and September 1979, was examined. Based upon hospital records, the average number of patients seen per provider per day in January was 20.2. In comparison, in September, after the implementation of impanelment, the average number of patients seen per provider per day was 16.9. Assuming seven providers, this is approximately 23 patients less per day, which is even greater than the theoretical figure of 16.5. This difference in the number of patients seen is due primarily to the fact that three providers are eliminated from the individual schedule. in order to use only two providers for actual patient care on the panel, with the third merely doing the screening.

Questionnaire B was used to determine patient satisfaction with the operation of the clinic. As previously mentioned, the first three questions were used in making comparative analyses of the answers to question four. For ease in comparing patients' feelings about the service they received and about the various personnel in the clinic, the five areas of response (Excellent, Good, Average, Fair, and Poor) were combined into two categories. The Excellent and Good responses were combined to form the "favorable" category, and the remaining responses formed the "unfavorable" category. Although a

number of comparisons were made between the responses to the questions and the various factors which might account for any differences (See Appendix 6), only the comparisons made on overall service are presented here because they alone were conclusive in all respects. The proportion of favorable responses was tested against the proportion of unfavorable responses to see whether the following factors were significant: whether the patient was seen by a physician or physician assistant, whether the patient was seen by the panel or as an individual appointment, and whether the waiting time was long or short. (See Table 5) In making this last comparison, a short waiting time included all waits of 10 minutes or less and also longer waits if the patient felt that the waiting time was reasonable. A chi-square test was then done to determine whether the differences, if any, in observed proportions were significant (72:253-258). The differences in satisfaction between the patients seen by a physician (71% favorable), and those seen by a physician assistant (82% favorable), and between the patients seen by the panel (69% favorable), and those with individual appointments (78% favorable), were not significant at the .005 level. However, the difference in satisfaction between the patients with short waiting times (83% favorable), and those with long waiting times (33% favorable), was significant at the .005 level. Other comparisons are tabulated and included in Appendix 6.

To determine the broken appointment rate for the clinic, the clinic appointment logs were used from a two week period that included the period of the study. During that time 865 appointments were booked for the general practice clinic. There were 48 no-shows during

TABLE 5

ANALYSIS OF OVERALL SATISFACTION

H_o: Overall Satisfaction is the same

H_a: Overall Satisfaction is not the same

degrees of freedom = 1

 $\chi^2_{.005} = 7.879$

	PRO	VID	ÐR
-			

Physician Physician Assistant

(78%)

(22%)

Favorable Unfavorable

57	(71%)	62	(82%)
23	(29%)	14	(18%)

$$\chi^2 = 2.523$$

not a significant difference for \propto = .005

APPOINTMENT	SYSTEM
Panel	Appointment

Favorable	25	(69%)	94	
Unfavorable	11	(31%)	26	

 χ^2 = .7200 not a significant difference for \propto = .005

	WAITING TIME			
	Short	,	Long	
Favorable	112	(83%)	7	(33%)
Unfavorable	23	(17%)	14	(67%)

 $\chi^2 = 21.60$

Significant difference for $\alpha = .005$

that period, or a broken appointment rate of 5.5% (See Appendix 7). Patients were counted as being no-shows if they simply didn't keep the appointment, and also if they cancelled the appointment too late for it to be given to another patient. This rate was slightly higher than the estimate of the hospital administrators, but still below the minimum rates mentioned in the literature and therefore regarded as highly satisfactory.

A minor portion of the data to be collected concerned starting and completion times for the providers. Each provider was given a form on which to indicate the time he saw the first patient in the morning and in the afternoon, and also the time that he completed care for the last patient of each period. Out of the seven providers in the clinic, only two returned these forms, and therefore not enough information was received to draw definite conclusions. During observation of the clinic, however, it did appear that providers were beginning and ending service approximately on time.

Discussion

In order to evaluate the meaning of the data collected on the two systems, some standard of performance must be used. Since the main reason for implementing the triage system was to increase the number of patients seen on a same day basis, this is one point of comparison that must be considered. Along with this, the ten basic tenets for assessing primary health care delivery systems as set forth by General Wesp will also be used (132). Since these guidelines were specifically developed for use by the Williams AFB Hospital and other

similar facilities, the major portion of evaluation will be along those lines. Finally, the expected results mentioned in Chapter 3 will also be used.

The clinic has expanded the availability of urgent appointments, although only by a very slight margin. However, since this has been accomplished at a significant cost in the total number of patients that can be seen, it is not felt that the present method is effective in achieving this goal.

The main thrust of the guidelines set forth by General Wesp is that clinics should make maximum use of impanelment and screening procedures, while at the same time ensuring an orderly flow of patients through the clinic. In this area it seems as though some improvements could be made. Generally, the screening procedures appear to be working well. Patients are being directed to either a physician or physician assistant for their care, and although no definitive data was collected in this area, it does appear as though the screener is performing accurate triage. However, the main problem with this system is the extended waiting times for triage patients, as evidenced by their longer total service times, which increase patient dissatisfaction with the clinic. Because of this, it is felt that the overall operation of the impanelment system as described in this study is not effective in improving total patient flow through the clinic. The system shows a great deal of promise though, and rather than return to an individual appointment system, a few minor changes in the operation of the system could increase the number of patients seen each day, as well as decrease the waiting times for the patients.

CHAPTER 6

FURTHER DISCUSSION AND RECOMMENDATIONS

As has been mentioned, triage is widely considered to be an effective and most promising tool for improving patient flow. In the case of the Williams AFB Hospital general practice clinic, however, triage seems to have hurt the system more than improved it. Although there has been a slight increase in the number of urgent appointments available, the large decrease in total number of patients seen per day more than offsets this gain. Furthermore, another aspect of the triage system implemented in this hospital which has hurt overall patient flow is the extended total service time associated with it. However, a few minor changes in the system could improve patient flow and yet keep triage as a basic principle.

Before explaining the recommendations which will be made for a new system, a more thorough examination of the guidelines prepared by General Wesp, the ATC Command Surgeon, and mentioned in the previous chapter, should be made. These were the primary considerations used in developing the proposed revisions for the triage system:

- 2d. Maximize the principle of empaneling patients for health care teams....
- 3. Develop patient-oriented scheduled systems that ensure...
 - b. Maximal use of appointed visits.
- c. Health care provider effectiveness thru appropriate use of all forms of standardized scheduling techniques...
- e. Increased PCC, ancillary services and support staff efficiency by an orderly patient flow throughout the working day.
- 4. Develop a patient treatment priority system at every medical facility based on...

- d. An awareness that most non-urgent care can be seen same day and reappointed for an indepth evaluation.
 Develop a patient treatment routing system that:
- Develop a patient treatment routing system that:
 a. Uses formally established screening protocol at all points of entry. No PCC delivery system can work well without screening....
- c. Appropriately matches patient needs to level of provider expertise thru graduated patient care....
- 6a. Concentrating on identifying and obtaining optimum resources required in the appointment desk function....
- 7. Develop a system for comprehensive care that...
- b. Provides the bulk of care via the appointment mode
- 8a. Establishing medically sound protocols for routing patients with known and suspected medical/surgical conditions via appointment desk. (132)

As will be shown, two simple changes in the operation of the triage system would not only increase the number of patients seen each day, but should also decrease the waiting times for triage patients. The first of these changes would be to eliminate the use of a physician assistant as a screener, and the second to use a modified wave appointment system for the triage patients.

By eliminating the use of a physician assistant as the triage agent, another provider would be available for primary patient care. There are then two possibilities for the skill level of the new screener. One possibility is to use the medical technicians who are already in training for screening, and the second is to train the personnel at the appointments desk to do screening on the telephone. As has been shown by Slay (109), effective triage can be performed by personnel with little or even no previous medical experience by using an algorithm-directed triage system. One such system is the excellent one developed by Vickery (125), and the hospital administrator at the base has estimated that it would only require about 20 hours to train personnel in its use. By stipulating that all patients who called for a same day appointment would be given one, the effects of mis-triage by these agents would be minimal. Since their triage function would simply be to assign the patient to either a physician or physician assistant, the worst that could possibly happen would be for the patient to be seen initially by a physician assistant and then referred to a physician, rather than being seen directly by the physician.

If the medical technicians were used as the triage agents, they could be employed in several different ways. The first way would be similar to the present screening system. After making appointments with the panel, patients would arrive at the clinic, be screened by the triage agent, and then assigned for care. However, this system alone would do little to reduce the excessive waiting times of the triage patient.

A second method would be for the screener to perform the triage over the telephone from the general practice clinic. By training all of the technicians assigned to the clinic to perform triage using an algorithm-directed system such as Vickery's, they would even be able to perform all of their regular duties as well. There are enough technicians assigned to the clinic so that no one is constantly busy. Whichever technician happened to be free would be able to answer the phone, perform the triage, and give the patient a definite appointment. Of course, this system moves away from the centralized appointment system, and would dramatically increase the number of telephone calls to the general practice clinic. However, this situation is not without precedent, as a similar system is

currently being used in the pediatric clinic at the same hospital. The effect of this method would be to drastically reduce waiting times, as the triage would actually be performed in the patient's own home and he would be able to simply report in time for his specific appointment.

A slight modification of this method would be to assign a technician to work at the appointments desk during the peak calling hours and perform the telephone screening of triage patients from there. This would have most of the same advantages as the previous method, while eliminating any need for changing the appointment making procedures, and also possibly providing additional help for the appointments desk during peak hours. However, a major disadvantage of this system lies in the fact that the medical technicians would not be able to utilize their skills and training to the fullest. This would be both inefficient and frustrating to those who would resent functioning as appointments clerks rather than as health care personnel. Similarly, if appointment clerks were trained to act as triage agents, they might resent being required to function as health care personnel, especially because they are already kept quite busy performing their regular duties.

Consequently, it is recommended that the medical technicians perform telephone screening in the general practice clinic. Since they are already being trained in this technique, they would be able to perform triage effectively almost immediately. It is also felt that patients would be more inclined to answer questions about their medical problems and history, if they knew they were consulting with

someone at the clinic rather than talking to an appointments clerk.

In addition to this change in the triage function, a change in the appointment structure for the triage patients is also recommended. Based upon the results of the questionnaire and other research, it is felt that the longer total service times of the triage patients is due not to the number of patients, but rather to scheduling too many patients to each appointment block with the panel. Because of the shorter provider service time for triage patients. an average of 8.55 min. per patient, it is felt that patients could actually be seen by providers at more frequent intervals than the 15 minute intervals used for the individual appointment system. To accomplish this, a modified wave appointment schedule is recommended for the physician and physician assistant assigned to the triage panel. As shown in Figure 4, five patients, rather than four, would be scheduled for each hour. Providers would still have ample time to perform paperwork and other duties as each patient is, in effect, booked for 1/5 of an hour or a 12 minute period. Appointments would still be given at 15 minute intervals, but two patients would be scheduled for each of the first two periods, one for the third, and none for the fourth. This is a typical wave pattern, allowing the provider a few minutes to catch up at the end of each hour. By scheduling less than five patients for certain hours, time for rounds. consults, and coffee breaks can still be worked into the schedule. The two providers assigned to the panel would see only urgent appointments; no routine appointments would be scheduled for them, except for provider requested follow up appointments as under the

FIGURE 4

MODIFIED WAVE APPOINTMENT SCHEDULE

Time	Individual Appointments Number of Patients	Triage Appointments Number of Patients
8:00	Rounds	Rounds
15	1	2
30	ī	2
4 5	1	0
9:00	1	2
15	1	2
30	1	1
4 5	1	0
10:00	1	2
15	Coffee Break	2
30	1	0
45	1	Coffee Break
11:00	1	2
15	1	2
30	1	1
45	1	0
12:00	Rounds	Rounds
15		
30	Lunch	Lunch
45		
13:00	1	2
15	1	2
30	1	1
45	1	0
14:00	1	2
15	1	2
30	1	1
45	1	0
15:00	Consult	Consult
15	1	2
30	1	2
45		1
10:00	1	U
20	nounas	rounds
∪ر ⊿ا		
כזי ריל היו	26	
Total	ratients 20	رر

ومتحقق ومردانه والمسالح والمتحدث ومرور الكرام والمرد

present system. Providers in the clinic would rotate triage duties on either a daily or weekly basis.

This schedule would increase the number of appointment slots available for triage from 40 to 66. Currently, there are about 87 urgent appointments available in the general practice clinic each day, including those scheduled for the panel. Based upon information obtained in an informal interview with the chief appointments clerk, it is apparent that the demand for urgent appointments is less than the current availability. There has always been an urgent slot available for any patient requesting one. Therefore it is recommended that the total number of urgent appointment slots for the clinic remain the same. Because more triage slots would be available under the new appointment schedule, it would have the effect of increasing the number of routine appointments available for the other providers. Assuming that demand for these appointments would remain unchanged, it is probable that the waiting time for routine appointments would be reduced to less than the present one week.

If it were decided to retain the screening function in the clinic, rather than allowing it to be performed by telephone, this same increase in the number of available appointments could still be realized. Rather than schedule the patients in a wave for the providers, they could be scheduled in a wave for the screener. To do this, ten patients would generally be scheduled for each hour, with two patients scheduled on the hour, and two patients each for the next four ten minute intervals. Again, the last period would be left free, allowing the providers time to catch up at the end of each hour.

To make the wave system work most effectively, a few priorities should be used by the triage agents when scheduling appointments. As suggested by Willis (134), an attempt should be made whenever possible to schedule one traditionally short service time patient during the periods when two patients are scheduled at the same time. For example, under the present triage system, the screener sees several patients each day who are simply requesting prescription refills. These patients would be given one of the two appointments scheduled at the same time under the proposed system. Similarly, if it were necessary to use one of these slots for a provider requested follow up appointment, the provider, when requesting the appointment for his patient, would estimate whether the appointment would be relatively long or short. The patient could then be scheduled accordingly.

It is estimated that making the two changes which have been proposed would increase the productivity of the clinic, in terms of number of patients seen each day, by 27% over the current system and by 10% over the individual appointment system. (See Table 6) These estimates were arrived at by using the appointment schedules rather than actual performance data. However, it is felt that although the clinic actually sees fewer patients per day than could theoretically be scheduled, the proportional increase in productivity would be approximately the same. Thus it can be seen that this new system would meet General Wesp's goal of making maximum use of both scheduled appointments and patient triage.

TABLE 6

APPOINTMENT AVAILABILITY*

TYPE OF PROVIDER: TOTAL APPTS.

URGENT APPTS. ROUTINE APPTS.

	Individual System		
Physician (3)	115	55	60
Physician Assistant (4)	122	65	57
Total Average	119	60.7	58.3

Present System

Physician (2)	115	55	60 57
Physician Assistant (2)	122	65	
Panel (3)	83	67	16
Total Average	103.3	63	40.3

	Proposed System		
Physician (2)	115	21	94
Physican Assistant (3)	122	25	97
Panel (2)	162	162	0
Total Average	131.4	63	68.4

* Average availability per week per provider, based on all providers working a normal schedule
Conclusions

In summary, it has been shown that triage, when used properly, can be an effective tool in improving patient flow in an outpatient clinic. Although the clinic at Williams AFB is making effective use of triage with respect to the screening and subsequent care of patients, this is being accomplished only with an unacceptable loss of productivity and a great increase in total service time for the patient. By changing the system slightly, both of these problems can be eliminated. The telephone screening of patients, done by medical technicians using algorithm directed techniques, coupled with a modified wave scheduling system for patients with urgent problems, can not only increase the number of patients that can be seen by a triage panel, but can also increase the availability of routine appointments. Although generally used only in emergency rooms or walk-in clinics, it is apparent that triage, applied in this manner, can also be an effective tool in improving patient flow in an outpatient clinic which is operated on an appointment basis.

It should be noted, however, that the sampling process used, a non-randomized selective sample over a four day period, is not necessarily the best sampling process, and could possibly produce biased results. Nevertheless, based on the results of the Nuffield studies (7, 77, 131), and the suggestions made by Rising (86), it is felt that the results in this case are accurate.

CHAPTER 7

RESEARCH CONTRIBUTION

This report on the effect of triage on patient flow in an outpatient clinic is significant and useful for several reasons. In the first place, although limited in scope, this study adds to the small but growing body of research on the subject of triage and impanelment, and is especially important as it deals with the problem of extending triage into an appointment setting. Although triage has been used for a number of years in emergency rooms and walk-in clinics, its use in an outpatient clinic with an appointment system is a very recent development. The promise of increased productivity which this new method affords is especially attractive in this era of rising costs, personnel shortages, and budget cuts. Furthermore, although numerous studies of patient flow systems have been conducted, the number done in a military setting such as this is relatively small (24, 41, 80, 82, 104, 109, 120, 121, 122, 134).

From a more practical standpoint, this research will be of concrete value to the administrators of the Williams AFB Hospital. Since this is a new system, they are concerned about its effectiveness and are committed to serious consideration of the recommendations made in this report.

Finally, an examination of this report suggests a number of areas that might merit further study. The most obvious of these, of course, would be to implement and then evaluate the proposed changes. Along with this, although general studies have already been performed comparing the overall effectiveness of various triage agents, a study specific to this clinic or to a military setting might also be done. Other possibilities might be to perform a more detailed analysis of the effect of waiting time on patient satisfaction, to study the effect of using a modified wave appointment system for the general practice clinic as a whole, or to compare the effectiveness of triage done by telephone to face-to-face triage. But whatever studies are done, it is certain that questions of provider productivity, patient flow, and patient satisfaction will always be of interest and use to hospital administrators, both in and out of the military.

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APPENDIX 1

SAMPLE INDIVIDUAL APPOINTMENT SCHEDULES

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APPENDIX 2

SAMPLE TRIAGE APPOINTMENT SCHEDULE

SSAN/Statu=/Phone	Appt Time Appt Time		Name /SSAN /Status / Dicne
	0830	.1300	
		"	
	"		
	H	*	
	0845	1330	
		"	
	*	× #	
	0930	1400	
	Ħ		
	и	*	
	0945	1430	
	R	•	
		•	
	-		
	1030		
		IR	
	•	ER	
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	•	ER	
00		1100	
∞		1100	
w		1540	
		1540	

APPENDIX 3

QUESTIONNAIRE A DATA

Individual	Appointments

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
	0945	PA	15	30
	0805	P	25	80
	0750	PA	05	50
	0824	PA	10	
	07 <i>5</i> 0	P	05	145
	0915	PA	10	4 <u>5</u> 20
	0920	P	10	20
	1 <i>5</i> 00	PA	20	+) 50
1115	1050	P	10	60
1130	1050	P	07	31
0815	0805	P	14	
0930	0950	PA		42
0815	0805	PA	17	45
1430	1340	PA	05	20
0800	0810	PA	15	20
1415	1400			
1345	1300	Р.		
1130	1120			
1100	1045			
0830	0810		05	15
1515	1500	PA		
1145	1115			
1115	1100	 DA	10	20
1100	1100	FA	10	
1045	1040	 DA	05	25
1030	1020	TA DA	05	25
0990	0900	TA DA	22	35
1/11 6	1/10	DA IN	05	15
1415	1250	DA IN	20	30
1900	1 2 2 0		10	25
1100	1045		15	30
10/15	001 5			75
1000	0919	PA	10	20
1000	0900		20	25
001 5	0900	PA	05	35
1030	1015	PA	10	25
1045	1035	PA	20	35
1100	1105	PA		
1115	1100	PA	06	16
1130	1120	PA	06	16
1145	1135	PA	15	25
1400	1345	PA	15	24
1 530	1531	PA	11	14
	1530	PA	10	40
0930	0910	P	06	26

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
0045	0935	P	10	25
1000	0950	P		
1030	1015	P	10	40
1130	1125	P		
1515	1510	P	20	25
1 530	1 520	P	05	25
1545	1 540	P	10	20
	0845	P	15	30
0900	0915	P	10	30
1045	1025	P	20	55
1400	1400	P	05	15
1 500	1445	P	15	60
1 51 5	1 500	P	20	70
1545	1529	P	15	45
	0938	PA	13	67
	1025	P	20	25
	1425	P	20	85
	0845	P	15	30
	1330		05	60
	0915	PA	05	20
	1000		20	105
	1345	P	15	95
	0854	P	10	91
	1 <i>5</i> 45	PA	05	35
	0845	P	10	30
0815	0811	P	05	59
	0800	P	07	52
0900	0845	P		
0930	0915	P	15	30
0945	0945	P	15	0E
1030	1025	P	01	10
1100	1050	P	02	12
1415	1400	P	04	10
1515	1 <i>5</i> 00	_ P	15	23 55
0815	0745	P	15	22
1330	1311	P	09	22 E E
1345	1330	P	25	77
0815	0800	PA	10	25
0930	0925	PA	01	20
1000	0950	PA	15	20
1100	1040	PA		
1115	1110	PA	10	<u></u>
1130	1055	PA	08	رر ۱۵۳
1315	1300	PA	45	- フフ 1ル2
1400	1145	PA	10	14
1530	1515	PA	05	20 20
0900	0900	PA	10	20

Individual Appointments Cont.

Individual	Appointments	Cont.
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Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
1115	1055	PA	10	20
1130	1100	PA	13	25
0815	0805	PA	05	25
1315	1310	PA	25	45
1300	1305	Р	15	45
1315	1300	P	25	60
1330	1320	P	15	40
0915	0900	PA	15	30
1330	1325	P	06	91
1000	0930	P	07	37
091.5	0915	P	30	40
0900	0815	Р	03	13
	0805	PA	08	23
	0815	PA	17	50
	1025		15	20
	1515	P	10	15
1315	1315	P	10	25
1545	1540	P	10	18
1 500	1446	PA		
1330	1315	P	15	30
1 500	1425	P	15	25
1400	1400	P		
1400	1400	P	20	50
	1315	PA	39	114
1345	1330	P	03	20
	1450		13	13
ن ن ن م ب	1 5 30	P	10	50
0845	0700	PA	20	<i>5</i> 0
0915	0855	PA	05	15
0945	0930	PA	10	15
1000	0950	PA	07	18
1030	1025	PA	10	15
1100		PA	05	
1130	1107	PA	15	28
1145	1125	PA	10	10
1415	1415			
1115	1105			
	1315	Р	15	60
	0745	P	20	45
	0950	PA	30	30
	1455	PA	05	20

Appt. Time	Arrival Time	Provider	Provider Service Time	Total Service Time
0830	0825	P	13	60
0845	0825	P	02	85
0945	0935	P	05	70
1030	1000	P	10	<i>5</i> 0
0930	0900	PA	10	40
0945	0915	PA	05	20
0930	0925	PA	15	35
1030	1010	PA	10	40
0930	0915	PA	10	40
0930	0925	PA	05	45
0845	0800			
	0710	-	10	
0845	0835	P	05	75
1430	1430	P	10	65
	1325	P		
	1337	PA		
	1255	P	05	80
	0935		10	100
	1420	P		
1300	1230	PA	05	95
1030	1010	PA		
1030	1035	PA	05	70
1400	1346	P	20	84
1300	1230	P	05	145
0845	0845	PA	05	148
0830	0810	P	10	60
0830	0815	P	10	85
1330	1317	P	27	85
1030	1015	PA	06	75
0930	0900	PA	07	45
1400	1350	PA	10	60
0930		PA	05	
1400	1300		01	65
1430	1400	P	20	125
0845	0830	PA	15	45
0930	0920	PA	10	50
1300	1230	PA	03	92
1030	0920	PA	05	15
1030	1025		02	08

Panel Appointments

APPENDIX 4

QUESTIONNAIRE A ANALYSIS

Sector States







Provider Service Times--Panel



The differences in the median service times and arrival times are tested for significance using the Mann-Whitney-Wilcoxon Test.

The test statistic is calculated using the formula:

$$Z_{x,L} = \frac{T_x + .5 - m(N + 1)/2}{\sqrt{\frac{mn}{12N(N-1)} (N(N^2 - 1) - (\Sigma u^3 - \Sigma u))}}$$

$$Z_{\mathbf{x},R} = \frac{T_{\mathbf{x}} - .5 - n(N+1)/2}{\sqrt{\frac{mn}{12N(N-1)}} (N(N^2 - 1) - (\Sigma u^3 - \Sigma u))}$$

For Provider Service Times:

m = 31 n = 116 N = 147

$$\sum u = 139$$
 $\sum u^3 = 97117$ T_x = 1670
 $Z_{x,L} = -3.007$ P = .0013

For Total Service Times:

m = 31 n = 114 N = 145

$$\Sigma u = 120$$
 $\Sigma u^3 = 12672$ T_x = 3286.5
Z_{x.R} = 4.9437 P< .0002

For Arrival Times:

$$m = 31$$
 $n = 100$ $N = 131$
 $\sum u = 118$ $\sum u^3 = 48226$ $T_x = 1782$
 $Z_{x,L} = -1.442$ $P = .0746$

* Correction factors are applied for continuity and for having a large number of ties.

*

The differences in the mean service times are tested using the Student-t test.

Using the test statistic:

$$Z = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

$$\int \frac{\sigma_1^2}{\sigma_1^2} + \frac{\sigma_2^2}{\sigma_2^2}$$

$$\int \sigma^2 \text{ is estimated by } s^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)}$$

For Provider Service Times:

$$\mathbf{\bar{x}}_{1} = 8.55$$
 $n_{1} = 31$ $\mathbf{\sigma}_{1}^{2} = 28.65$
 $\mathbf{\bar{x}}_{2} = 12.45$ $n_{2} = 116$ $\mathbf{\sigma}_{2}^{2} = 54.529$
 $\mathbf{z} = -3.303$ $\mathbf{P} = .0005$

For Total Service Times:

$$\bar{\mathbf{x}}_1 = 68.29$$
 $n_1 = 31$ $\mathbf{0}_1^2 = 1103.08$
 $\bar{\mathbf{x}}_2 = 37.49$ $n_2 = 114$ $\mathbf{0}_2^2 = 641.28$
 $z = 4.798$ P < .0002

APPENDIX 5

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QUESTIONNAIRE B DATA

A B C D E F G	Excellent 62 (40%) 85 (60%) 72 (53%) 59 (46%) 68 (52%) 68 (52%) 43 (28%)	Good 57 (37%) 36 (25%) 41 (30%) 45 (35%) 39 (30%) 37 (28%) 49 (32%)	RATING Average 28 (18%) 12 (8%) 20 (15%) 21 (15%) 21 (17%) 18 (14%) 25 (19%) 30 (20%)	Fair 8 (5%) 5 (4%) 3 (2%) 2 (2%) 4 (3%) 2 (1%) 13 (8%)	Poor 1 (0%) 4 (3%) 0 2 (1%) 0 18 (12%)
		CLINIC-	TOTAL		
A B C D E F G	59 (44%) 83 (65%) 70 (58%) 57 (51%) 65 (57%) 64 (54%) 41 (30%)	53 (39%) 35 (28%) 38 (31%) 41 (36%) 34 (30%) 33 (28%) 49 (36%) CLINICS	16 (12%) 8 (6%) 13 (11%) 15 (13%) 15 (13%) 20 (17%) 24 (18%) SHORT WAIT	6 (4%) 1 (1%) 0 1 (0%) 1 (1%) 11 (8%)	1 (1%) 0 0 0 0 11 (8%)
A B C D E F G	3 (14%) 2 (13%) 2 (13%) 2 (14%) 3 (19%) 4 (28.5%) 2 (12%)	$\begin{array}{c} 4 & (19\%) \\ 1 & (6\%) \\ 3 & (20\%) \\ 4 & (29\%) \\ 5 & (31\%) \\ 4 & (28.5\%) \\ 0 \end{array}$	12 (57%) 4 (27%) 7 (47%) 6 (43%) 3 (19%) 5 (36%) 6 (38%)	$\begin{array}{c} 2 & (10\%) \\ 4 & (27\%) \\ 3 & (20\%) \\ 2 & (14\%) \\ 3 & (19\%) \\ 1 & (7\%) \\ 2 & (6\%) \end{array}$	0 4 (27%) 0 2 (12%) 0 7 (44%)

CLINIC--LONG WAIT

					94
CATEGORY	Excellent	Good	RATING Average	Fair	Poor
A B C D E F G	49 (41%) 71 (64%) 57 (56%) 46 (48%) 53 (55%) 52 (53%) 29 (24%)	45 (37%) 27 (24%) 30 (29%) 33 (35%) 28 (29%) 27 (28%) 40 (35%)	18 (15%) 10 (9%) 13 (13%) 15 (16%) 13 (13%) 18 (18%) 23 (19%)	7 (6%) 1 (1%) 2 (2%) 1 (1%) 2 (2%) 2 (2%) 11 (9%)	$ \begin{array}{c} 1 & (1\%) \\ 2 & (2\%) \\ 0 \\ 1 & (1\%) \\ 0 \\ 15 & (1\%) \end{array} $
		INDIVIDUAL /	APPOINTMENTS		
A B C D E F G	13 (36%) 14 (45%) 15 (44%) 13 (41%) 15 (44%) 16 (49%) 14 (40%)	12 (33%) 9 (29%) 11 (32%) 12 (37%) 11 (32%) 10 (30%) 9 (26%)	10 (28%) 2 (6.5%) 7 (21%) 6 (19%) 5 (15%) 7 (21%) 7 (20%)	1 (3%) 4 (13%) 1 (3%) 1 (3%) 2 (6%) 0 2 (6%)	0 2 (6. <i>5</i> %) 0 1 (3%) 3 (8%)
		PA	NEL		
A B C D E F G	33 (41%) 46 (60%) 41 (53%) 31 (48%) 33 (52%) 34 (49%) 22 (27%)	24 (30%) 15 (19%) 22 (28%) 21 (33%) 15 (23%) 19 (28%) 22 (27%)	19 (24%) 9 (12%) 12 (15%) 10 (16%) 12 (19%) 14 (20%) 17 (20%)	4 (5%) 5 (6%) 3 (4%) 2 (5%) 2 (5%) 2 (7%)	0 2 (3%) 0 1 (1%) 0 14 (17%)
		PHYS	ICIAN		
A B C D E F G	29 (38%) 39 (60%) 31 (53%) 28 (44%) 35 (52%) 34 (54%) 21 (29%)	33 (44%) 21 (32%) 19 (33%) 24 (38%) 24 (36%) 18 (29%) 27 (37%)	9 (12%) 3 (5%) 8 (14%) 11 (18%) 6 (9%) 11 (17%) 13 (18%)	4 (5%) 0 1 (1.5%) 7 (10%)	$ \begin{array}{c} 1 & (1\%) \\ 2 & (3\%) \\ 0 \\ 1 & (1.5\%) \\ 0 \\ 4 & (6\%) \end{array} $

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PHYSICIAN ASSISTANT

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APPENDIX 6

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QUESTIONNAIRE B ANALYSIS

The differences in proportions are tested using the Chi-square test.

The test statistic is calculated using the formula:

$$\chi^2 = \sum \sum \frac{(\mathbf{f}_{ij} - \mathbf{e}_{ij})^2}{\mathbf{e}_{ij}}$$

degrees of freedom = 1 $\alpha \approx .005$

The hypothesis tested is that the satisfaction is the same for type of provider seen, type of appointment (panel or individual), or a long or short waiting time.

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Question 4a--Overall Service

	Physician	Assistant
Favorable	57	62
Unfavorable	23	14
$a^2 - 2$	500 mat -	i mai fi an a

$$\chi^{2} = 2.523$$
 not significant

Individual Panel Appointment

Physician

Favorable	25	94	
Unfavorable	11	26	

$$\chi^2$$
 = .7200 not significant

Short Long
Favorable 112 7
Unfavorable 23 14

$$\chi^2 = 21.60$$
 significant

4bService	That Day	Physician	Physician Assistant	
	Favorable	61	60]
	Unfavorable	16	5]
	$\chi^2 = 7.3$ however	89 not sign	gnificant f ificant for	or A = .005, A = .01
		Panel	Individual Appointmen	t
	Favorable	23	98	7
	Unfavorable	8	13	
	χ^2 = 2.	300 not s:	ignificant	
		Short	Long	
	Favorable	118	3	
	Unfavorable	9	12	
	$\chi^{2 { m not}}$	valid if a	ny cell has	n < 5

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Question 4g--Appointment System

	Physician	Physician Assistant
Favorable	44	48
Unfavorable	37	24
χ^2 = 2.806 not significant		
/•		
	Panel	Individual Appointment
Favorable	Panel 23	Individual Appointment 69
Favorable Unfavorable	Panel 23 12	Individual Appointment 69 49

Question
Question 4g--Appointment System Cont.



A test was also made on whether or not there was a significant difference in satisfaction with overall service and satisfaction with the appointment system. A Z test was used, as well as the chi-square test, using the test statistic:

$$Z = \frac{\frac{x_1}{n_1} + \frac{x_2}{n_2}}{\sqrt{\hat{p} (1 - \hat{p}) (\frac{1}{n_1} + \frac{1}{n_2})}} \text{ where } \hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

$$x_1 = 92$$
 $x_2 = 119$ $n_1 = 153$ $n_2 = 156$
Z = 25.762 significant with **P** \simeq 0

For the chi-square test:

	Appointment	Overall		
Favorable	92	119		
Unfavorable	61	37		

 $\chi^2 = 9.028$ significant for $\propto = .005$

APPENDIX 7

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BROKEN APPOINTMENT RATE

The broken appointment rate was calculated using completed appointment logs from the general practice clinic. The period 1-11 October 1979 was used. An appointment was considered broken if the patient was a no-show, or if the appointment was cancelled too late to be filled by another patient.

Appointments Booked = 865

No-shows = 48 No-show rate = $\frac{48}{865}$ = 5.5%

APPENDIX 8

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APPOINTMENT AVAILABILITY AND NUMBER OF PATIENTS SEEN

The average number of appointments available per provider per week was calculated by taking an average of the average number of available slots for each provider for a typical week.

		Total Avail.	Urgent	Routine
Physician	#1	118	43	75
	#2	123	66	57
	#3	104	57	47
Physician				
Ass't.	#1	117	64	53
	#2	129	69	60
	#3	123	64	59
	#4	117	62	55
Avg. Phys:	ician	115	55	60
Avg. Phys	. Ass't	. 122	65	57

The availability of Panel appointments was calculated based on an average of 250 per week, with 50 routine appointments. The panel uses two physician assistants and one physician.

For the proposed system, the average number of appointments for each of the two providers assigned to the panel is 162 urgent appointments per week. The total appointments for the other providers will remain the same, however, the number of urgents and routines will change. To calculate this, the remaining urgent appointments (based on keeping the total for the clinic the same) were allocated to the two types of providers in the same proportions used in the old system. This was then subtracted from the total available to determine the number of routine appointments.

Actual Number of Patients Seen

Hospital records were used to determine the actual number of patients seen in the general practice clinic. The total number of patients seen by each of the seven providers in the clinic was used. There were 22 duty days in January and there were 15 duty days under impanelment in September.

Month	Number of Patients Seen	Avg. Number of Days Worked per Provider	Avg. Number of Pati- ents Seen per Provider
Jan. 1979	2764	19.5	20.2 per day
Sept. 1979	1487	12.6	16.9 per day

APPENDIX 9

SAMPLE QUESTIONNAIRES

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Contraction

To the patient:

The purpose of this survey is to determine the effectiveness of the appointment system at this hospital. Although I am conducting it to fulfill part of the requirements for a Masters Degree from Arizona State University, Col. Moore, the Hospital Commander, has given me his support and will receive a copy of my final report. Flease answer all questions as accurately as possible, so that the results can be used to improve the service you receive here. Disclosure of the last four of the sponsor!s SSAN is voluntary, but is needed for correlating data. All questionnaires are strictly confidential. Thank you for your cooperation.

JOHN W. KOCH, Capt, USAF AFIT Sponsored Graduate Student

QUESTIONNAIRE A

1.	Last four numbers of sponsor's SSAN.
2.	What time did you arrive at the clinic?
3.	When did you call for your appointment? (circle one) today yesterday 2-5 days ago 6-10 days ago more than 10 days ago
4.	If you called for your appointment today, what time did you call?
5.	Is this a follow-up appointment? YES NO (circle one)
6.	What time were you seen by the screener or medical technician?
7.	After you were seen by the screener or medical technician, were you then seen by a: doctor, physician assistant, or nurse practitioner? (circle one)
	Time you were called into the office.
	Time you left the office.
8.	Were lab tests ordered prior to being seen? YES NO (circle one)
9.	Were more tests ordered after being seen? YES NO (circle one)
	If YES, did you have to wait for the results, and then be seen again the same day? YES NO (circle one)
	Time you were called into the office the second time.
	Time you left the office the second time.
10.	If you were first seen by a physician assistant or nurse practitioner and then referred to a doctor:
	Time you went into the doctor's office.
·	Time you left the doctor's office.

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QUESTIONNAIRE B

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ι.	Wer	e you see	n by a:						
		doctor	physici	an assista	nt nur	se prac	titioner	(circle	one)
2.	How	long did	you have t	o wait befo	ore you w	ere seer	n? (circ]	le one)	
	0-5	min	6-10 min	11-15	min	16-20 mi	n 21-:	30 min	
-	31 -	45 min	more that	n 45 min					
3.	Did	you feel	that the w	maiting tim	e was:	((circle or	ne)	
	too	long	long but	reasonable	under th	ne circum	nstances	reas	onable
4.	How do you feel about the following aspects of this hospital? Place an X in the appropriate column.					.ce			
				Ex	cellent	Good	Average	Fair	Poor
	a.	The over	all service	3					、 <u> </u>
	Ъ.	The serv today	ice you red	eived					~
	c.	The phys	icians						
	d.	The nurs	es						
	e.	The phys	ician assis	stants		فبسبيهم			
	f.	The medi	cal technic	ians					
	g.	The appo	intment sys	stem					

5. What do you like the most about this hospital?

6. What do you like the least about this hospital?

7. What suggestions do you have to improve the service at this hospital?

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BIOGRAPHICAL SKETCH

John Wallace Koch was born in Akron, Ohio, on December 2, 1949. He received his elementary education in the Parma, Ohio, public schools. Although his secondary education began in this same system, it was completed at Cross Keys High School in Atlanta, Georgia. In 1967 he entered the United States Air Force Academy in Colorado Springs, Colorado, and graduated with a Bachelor of Science degree in Engineering Mechanics in 1971. After being commissioned as a Second Lieutenant in the United States Air Force, he attended undergraduate pilot training, and subsequently served as a pilot in the Air Force from 1972 to 1978. As a Captain in the Air Force, his graduate education began in 1978 when he entered the Graduate College at Arizona State University in Tempe, Arizona, in the field of Industrial Engineering. He is a member of Alpha Pi Mu, the Industrial Engineering honor society. He married Sandra Lee Michalek of Seven Hills, Ohio, in 1971, and is the father of three children, Jennifer, Nathan, and Ryan.