



A STUDY OF THE OUTPATIENT PHARMACY QUEUE AT THE  
U. S. PUBLIC HEALTH SERVICE HOSPITAL,  
NEW ORLEANS, LOUISIANA

The writer wishes to express his appreciation to the following personnel of the United States Public Health Service Hospital, New Orleans, Louisiana for their outstanding cooperation: Submitted to the Faculty of Baylor University; James E. Sabo, Associate Director; Seward Proctor, Assistant to the Director; and the officers of the Hospital for their sincere interest and cooperation, this report could not have been completed.

A Problem Solving Thesis  
Submitted to the Faculty of  
Baylor University  
In Partial Fulfillment of the  
Requirements for the Degree  
Master of Health Care Administration


By

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Waco, Texas

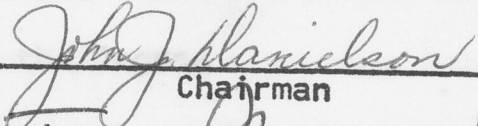
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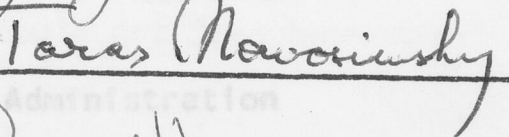
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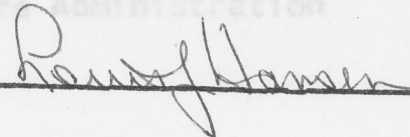
  
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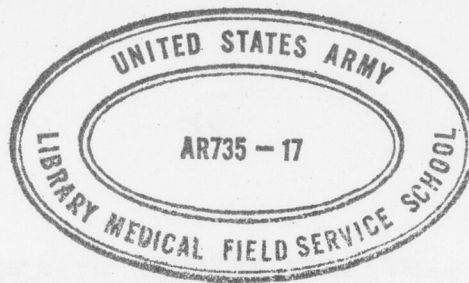
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mands placed upon the hospitals of this nation often present a challenge to the hospital's administrators and pharmacists.

This problem is particularly acute in the older facilities, which were designed and built over a decade ago to serve a small fraction of today's patient workload.

The pharmacy is the most extensively used of the therapeutic facilities of the hospital.<sup>1</sup> Doctor Malcolm T. MacEachern expands further on the subject:

[Frequently it] is not organized or managed as its importance deserves. It has experienced its greatest development in recent years through the growth of dispensaries or outpatient departments and through epochal advances in chemotherapy and the use of antibiotic drugs. The pharmacy department should supply both the inpatient and outpatient services with all drugs, whether they be stock drugs and solutions or prescriptions. In addition, it is customary to place under the control of the pharmacist those articles known to the trade as "drug-gists' sundries."<sup>2</sup>

The primary function of the outpatient pharmacy is the

## CHAPTER I

### INTRODUCTION

#### General Information

At a time in the history of man when medical care is increasingly considered a "right," the pharmaceutical demands placed upon the hospitals of this nation often present a challenge to the hospital's administrators and pharmacists.

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The primary function of the outpatient pharmacy is the

accurate filling of pharmaceutical prescriptions and requirements. Equally important is accurate communication with each individual outpatient to insure his or her understanding of the instructions on the label.

Providing essential pharmaceutical services within selected specifications of quality and quantity leads to a problem of waiting lines, or queues. The queue in the outpatient pharmacy is important because it is related to the relative satisfaction of the outpatient and to the efficiency of the pharmacy itself.

#### Hospital Setting and History

The United States Public Health Service is the principal health agency of the federal government, with the mission of protecting and advancing the health of the American people. It had its inception on July 16, 1798, when President John Adams created the United States Marine Hospital Service. In 1902, its name was changed to United States Public Health and Marine Hospital Service and, in 1912, was finally changed to United States Public Health Service.

United States Public Health Service personnel, both commissioned officers and civil service, are assigned throughout the United States and selected foreign countries to conduct complex health programs, including direct medical

care for eligible beneficiaries; disease research, prevention, and control; radiological and mental health; air pollution and chronic disease control; and accident prevention.

The United States Public Health Service has been in New Orleans since 1802, when Congress appropriated \$3,000 for the relief of sick and disabled seamen. The appropriation marked the first acceptance by the United States of its responsibility to provide medical care for United States citizens in an unhealthy foreign port.

The first medical officer in charge was William Bache, a grandson of Benjamin Franklin. Dr. Bache rendered medical care to seamen aboard ship because there was no hospital structure.

Wars and disasters precluded permanence of location until 1870, when the present hospital site was acquired, and the final hospital construction was completed in April, 1885.

The first hospital buildings were frame structures which were continually improved until 1929, when these primary structures were razed. Construction was started on the present building and was completed in 1931, at a cost of

\$2,500,000. It was constructed of brick, was fireproof throughout, and enjoyed the benefits of air and sunshine through the spread X arrangement of its wings (see Appendix A).

The United States Public Health Service Hospital, 210 State Street, New Orleans, Louisiana, is a general medical and surgical hospital accredited by the Joint Commission on Accreditation of Hospitals. The 17.4 acres within the reservation walls contain 22 buildings, of which seven contain 16 sets of quarters. The main hospital building, represented by 190,000 square feet, has a constructed bed capacity of 329, and the erected beds total 403.<sup>3</sup> The average daily patient load approximates 325, and the annual outpatient visits total 145,000.

The eligible beneficiaries treated at the hospital include: American seamen, active duty and retired members of the uniformed services and their dependents, federal prisoners, persons with Hansen's disease, foreign seamen, or patients having unusual conditions requiring examination or treatment of value to a hospital teaching program. All patients are available as teaching cases. Over 40 per cent of the staff physicians hold teaching appointments at Tulane University or Louisiana State University medical schools.

The hospital pharmacy is responsible for complete pharmacy service. The pharmacy collects and issues pharmacological information, conducts residency training, and operates both a poison control center and a drug information center on a 24-hour basis. The pharmacy issues a hospital formulary to indicate those approved drugs stocked by the hospital pharmacy.

### Conditions Which Prompted the Study

The hospital outpatient pharmacy has frequently had patients wait 40 to 50 minutes for prescriptions and requisitions to be filled after they were received by the pharmacists. At times, the waiting period has extended over 1 hour and 5 minutes. These queues are in addition to the 1 to 10 minutes which the patient must stand in line to hand the prescription over to the pharmacist.

The waiting lines at times extend through the waiting room doorway, spilling into the first floor hallway of the hospital and causing further congestion to the normal traffic flow.

### Statement of the Problem

The problem is to determine the best method of

shortening the queue in the outpatient pharmacy at the United States Public Health Service Hospital, New Orleans, Louisiana.

#### Limitations

The administrator Objectives that:

It is necessary to achieve several select objectives in solving the problem. These objectives are intended to be accomplished in the following order but may overlap. They are to:

1. Achieve a comprehensive analysis of the outpatient pharmacy as it functions in the United States Public Health Service Hospital, including the gathering of relevant data.

#### Assumptions

For the purpose of this study, the following assumptions are made:

1. The hospital mission will remain the same.

2. The outpatient pharmacy will continue to serve an equal number of patients.

#### Criteria

Any proposed solution to the stated problem should:

1. Result in significantly reduced queues in the outpatient pharmacy.
2. Maximize the use of assigned pharmacists in the outpatient pharmacy.
3. Result in significant improvement in the layout of the outpatient pharmacy.
4. Provide a patient-oriented environment for the

outpatients during their waiting period.

### Limitations

The administrator indicated that:

1. The existing outpatient pharmacy and the office in the inpatient pharmacy are the only two locations to be considered for the outpatient pharmacy because of long-range hospital plans.

2. The financial expenditure for architectural change should be limited to a "reasonable" amount.

### Assumptions

For the purpose of this study, the following assumptions are made:

1. The hospital mission will remain the same.

2. The outpatient pharmacy will continue to serve an equal or a greater number of outpatients.

3. The financial resources will be available as planned to implement minor architectural changes in the existing pharmacy or to relocate the outpatient pharmacy in the present inpatient pharmacy.

4. The resident training program for Public Health Service pharmacists will continue.

### Research Methodology

The initial visit to the United States Public Health

### Definitions

For the purpose of this study, the following definitions apply:

Arrival rate is the average rate at which persons or items appear at a servicing facility for service.

Challenge is the recognition by a pharmacist that a pharmaceutical in the outpatient pharmacy needs corrective action and the initiation of such action.

Passout is an item dispensed by the pharmacy which does not require a prescription.

Poisson means random and unscheduled.

Prescription is a written direction for the preparation and the use of a medicine. It is also a medicine prescribed.

Pushup is a priority prescription or requisition.

Requisition is a pharmacy-dispensed item not considered prescription.

Queue discipline is the manner in which arriving customers are selected for service.

Servicing rate is the rate at which the servicing facility can handle the incoming calls for service.

### Research Methodology

The initial visit to the United States Public Health

Service Hospital took place the week of February 16-20, 1970. During this time, interviews were conducted with the hospital director and the hospital administrator in order to define the problem area. Selected interviews were also conducted with the assistant administrator, the chief of financial management, the chief of general services, and others.

Interviews conducted with the chief of the pharmacy department and all key staff members of the pharmacy enabled the writer to obtain relevant data pertinent to the problem.

A review of the current available literature was accomplished before, during, and after the initial visit in order to gain an intimate knowledge of pharmacy operations and queueing theory.

A systems analysis was performed on the outpatient pharmacy operation. Data were collected and recorded to reflect the source of each outpatient who appeared at the service counter of the outpatient pharmacy (Appendix B). Staffing data were collected to indicate the number of pharmacists providing service throughout the normal operating hours (Appendix C). Records were established of the arrival time of each outpatient, the time that each pharmaceutical order was ready for pickup by the outpatient, and the multiple pharmaceutical orders. Clinic source, arrival time,

queue length, and dispensing time were portrayed graphically for each of five days during the initial week of the 2-week analysis from April 13 to April 17, 1970 (Appendix B).

A simulated prescription was flowcharted to exemplify outpatient pharmacy functions, and outpatients were sampled to determine the hourly cost of their waiting time.

### Literature Review

A review of the literature reveals that outpatient pharmacies have many problems of a similar nature as well as problems that are "one of a kind." Outpatient pharmacies are as inherently different as are fingerprints, and the solutions to their problems must similarly be tailored to each pharmacy in light of its total environment.

Historically, the pharmacy was the concern of the registered nurse. As recently as the 1940's, the pharmacy was a stranger to many hospitals, and even today many small hospitals still do not have a full-time pharmacist.<sup>4</sup>

As pharmacies have grown in quantity and quality, interest has been generated on a nationwide basis, resulting in expressed minimum standards for pharmacies in hospitals. These standards were established by the Division of Hospital Pharmacy of the American Pharmaceutical Association and the American Society of Hospital Pharmacists.<sup>5</sup> These standards

cover organization, policy, personnel, facilities, responsibilities, the pharmacy, and the therapeutics committee.

A standard is normally defined as something set up as a rule for measuring or as a model to be followed. A standard, however, cannot possibly cover all facets of an operation. The pharmacist's managerial technique must be refined through thorough literature review and mature application of final determinations. He must judge in an objective, professional, and impartial manner.

The first textbook devoted entirely to hospital pharmacy, written by William E. Hassan, Jr., was published in 1966.<sup>6</sup> Many articles are published on the subject of administrative and professional practices within an institutional pharmacy, resulting in excellent annual administrative reviews and bibliographies.

Most hospital pharmacies at one time or another have had problems caused by lack of space. To a conscientious department head, the chance to decrease the difficulties caused by space problems becomes a challenge.<sup>7</sup> One pharmacy discovered cabinets with shelves that revolved in lazy-susan fashion and later discovered potential in shelving which moved in Ferris wheel concept.

Authorities in the field have divided the functions

of a manager into five areas--planning, organizing, staffing, directing, and controlling.<sup>8</sup> It is imperative that the outpatient pharmacy manager examine these functions in light of the hospital pharmacy. Experience is said to be the best teacher, but it is costly in terms of time required.<sup>9</sup> Courses in management should be offered to the pharmacy student at both undergraduate and graduate levels, as it is absolutely necessary to the outpatient pharmacy manager.

The outpatient pharmacist must be concerned with the patient as a human being. The need for the pharmacist to be more concerned about the patient and less product-oriented finally has been realized.<sup>10</sup>

The waiting line, or queue, within the outpatient pharmacy affects the outpatient morale, depending upon the length of the queue; therefore, shortening the queue to a reasonable length is a worthy goal. The queue affects the efficiency and the economy within the pharmacy as well as the satisfaction of the pharmacy outpatient. It is for the patient's benefit that the pharmacy exists.

Available references on queueing theory are oriented primarily toward business. Some references pertain to hospital activities other than the pharmacy.

If outpatient care is to be made acceptable to the

patient and still remain efficient, some balance between the patients' waiting time and the doctors' idle time must be achieved.<sup>11</sup> The problem is somewhat different, since the doctor's outpatient may be scheduled but the pharmacist's outpatient is poisson. The pharmacists' outpatient may be a walk-in seeking a refill or he may have had an earlier doctor's appointment. In any case, his arrival at the outpatient pharmacy is random, and he must be serviced as efficiently and as rapidly as possible.

#### Footnotes

<sup>1</sup>Malcolm T. MacEachern, Hospital Organization and Management (3rd ed.; Berwyn, Ill.: Physicians' Record Co., 1962), p. 461.

<sup>2</sup>Ibid.

<sup>3</sup>U. S., Department of Health, Education, and Welfare, Public Health Service, Bureau of Health Services, Division of Direct Health Services, United States Public Health Service Hospital, New Orleans, Louisiana, by Harold G. Scott (Washington, D. C.: Government Printing Office, 1968), p. 10.

<sup>4</sup>Doris M. Allemand, "Needed--Better Pharmacy Service," Hospitals, XLIII (November, 1969), 96.

<sup>5</sup>MacEachern, Hospital Organization and Management, p. 507.

<sup>6</sup>Herbert S. Carlin, "Pharmacy," Hospitals, XLI (April, 1967), 149.

<sup>7</sup>Lloyd Logan, "A Pharmacy 'Room-Stretcher,'" Hospital Progress, L (March, 1969), 26.

<sup>8</sup>Harold Koontz and Cyril O'Donnell, Principles of Management (New York: McGraw-Hill Co., Inc., 1959), chap. i.

<sup>9</sup>Robert L. Lantos, "What Management Means to the Hospital Pharmacist," American Journal of Hospital Pharmacy, XXV (May, 1968), 215.

<sup>10</sup>Dwight R. Tousignaut, "Pharmacy," Hospitals, XLIV (April 1, 1970), 137.

<sup>11</sup>Robert B. Fetter and John D. Thompson, "Patients' Waiting Time and Doctors' Idle Time in the Outpatient Setting," Health Services Research, I (Summer, 1966), 66.

#### DISCUSSION

##### Outpatient Pharmacy Operations

Public Health Service Hospital, Outpatient Pharmacy, and include: (1) providing information about staffing, (2) presenting consideration on the existing physical layout, (3) presenting consideration on the alternative to the existing physical layout, and (4) providing interpretation of relevant statistics.

The functions of the hospital are shown in Appendix D. The outpatient pharmacy is directly under the deputy chief, pharmacy department.

The outpatient pharmacy is normally staffed with three pharmacists from a rotating assignment roster. (See Appendix D for the pharmacy staffing chart.) The staffing, in reality, fluctuates between one and five pharmacists.

There are five basic functions within the outpatient pharmacy which may be performed by up to five pharmacists.

These five functions are: (1) receiving, (2) typing, (3)

filling, (4) checking, and (5) dispensing.

The functions of receiving includes checking the identification (Appendix C), challenging the prescriptions (Appendix E), challenging the prescriptions, issuing any passouts, rotating to another selected function at a pre-determined time.

CHAPTER II  
DISCUSSION

Outpatient Pharmacy Operations

This chapter contains a discussion of the New Orleans Public Health Service Hospital Outpatient Pharmacy and includes: (1) providing information about staffing, (2) presenting consideration on the existing physical layout, (3) presenting consideration on the alternative to the existing physical layout, and (4) providing interpretation of relevant statistics.

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filling, (4) checking, and (5) dispensing.

The functions of receiving includes checking the identification (Appendix E), receiving the prescriptions (Appendix E), challenging the prescriptions, issuing any passouts, rotating to another selected function at a predetermined time, and screening for the pushups.

The function of typing includes typing all labels (Appendix E), challenging prescriptions, and answering the telephone.

The function of filling includes filling all prescriptions and challenging all prescriptions.

The function of checking includes checking all prescriptions, challenging all prescriptions, returning bulk stock to source location, and setting up prescriptions for the convenience of the dispensing function. This function must be performed by a pharmacist other than the one performing the functions of receiving, typing, and filling.

The function of dispensing includes dispensing all prescriptions properly, challenging prescriptions, and rotating to another selected function at a predetermined time. The functions of checking and dispensing may be accomplished by one pharmacist.

A number of factors appear to be responsible for the growth of outpatient prescription services offered by the 200+-bed hospitals. Significant influences are growth of outpatient clinics in hospitals, teaching functions of the hospital, better control of investigational drugs prescribed for outpatients, and combination of professional and public recognition of an increased need for ambulatory care.

The outpatient pharmacy of a teaching hospital serves as a laboratory in which residents develop proper prescription habits. While discrepancies in prescription writing quite often could be prevented by consulting the hospital formulary, nevertheless, they occur, and their correction by the pharmacist is time consuming.<sup>1</sup>

The pharmacy residency program is a two-edged sword. It is a means of providing better outpatient pharmacy services, and, as a by-product, the young pharmacists are privy to the physical and the functional aspects of the pharmacy for familiarization and training. While it is assumed that the new resident is inexperienced, the degree of relative proficiency is difficult to measure. Diligent scheduling should preclude compounding the inexperience of two or more new residents to the detriment of the outpatient pharmacy queue.

The physical location of the outpatient pharmacy of the United States Public Health Service Hospital, New Orleans, Louisiana, is on the main floor of the hospital, convenient to all outpatient traffic. It is in close proximity to the clinics and washroom facilities, and it has a waiting room.

### The Waiting Room

The outpatient pharmacy waiting room of the United States Public Health Service Hospital, New Orleans, Louisiana, severely handicaps the outpatients by its extremely limited capacity. The waiting room is capable of seating fifteen persons with its present arrangement. A few more seats could be added, but this would result in an uncomfortable, restricted seating arrangement. If fifteen were the maximum number of people waiting for prescriptions from the outwindow, then the outpatients could relax. However, the queue length has reached forty-one outpatients or seventy-seven prescriptions (using the formula  $Q_o = 1.88P_o$ , where  $Q_o$  equals the outwindow queue and  $P_o$  equals the patients waiting for their prescriptions at the outwindow. The 1.88 equals the average number of prescriptions expected of an outpatient based upon the sample week.).

The service windows in the outpatient pharmacy may be reversed. If the inwindow were the more distant window

from the door to the waiting room, the floor could be marked so that the queue at the inwindow could form around the perimeter of the waiting room instead of projecting through the doorway into the hallway. Only very long lines would then reach the hallway. When the queue projects into the hallway, outpatients entering or departing the pharmacy must excuse themselves to cut through the existing queue and pass through the doorway (see Appendix F).

Growth and increasing acuteness of space needs are reflections and direct products of the overwhelming development of medicine and the pharmaceutical industry in recent years.<sup>2</sup> With more sophistication in medicine, still more drugs will be added to formularies, and there will be an increased demand for storing and dispensing equipment within the outpatient pharmacy. These facilities require an increasing amount of floor and wall space.

The waiting room consistently lacked eye appeal during the sample period; the outpatients in the queue faced four walls without benefit of window decor, pictures, or magazines.

Today's society, experiencing explosions in color, texture, and pattern, as well as emotional stresses, is in search of environments which are not only appealing but also

satisfying.<sup>3</sup> People are more appreciative of a satisfactory environment and more critical of an unsatisfactory environment. Planners must create a balance with due consideration for the variety of outpatient illnesses, outpatient discomforts, and limited outpatient tolerance.

Questions that the outpatient pharmacy manager might ask himself include: (1) For what periods of time are patients exposed to the environmental colors? (2) What are the nature and the severity of the illnesses of these patients? (3) Are the colors conducive to patience during extended waiting? (4) Will a pleasing environment encourage the outpatients to remain near the outpatient pharmacy to preclude repeated paging and wasted time? Research has indicated which colors and which families of colors produce more or less favorable psychological effects upon the viewer.<sup>4</sup> Reds, yellow, and orange stimulate; blues and greens have a calming influence; and too much gray causes melancholia. Planners must consider these factors.

An awareness should be maintained by the outpatient pharmacy manager to insure a decor complementary to the painted walls that will enhance the outpatient's wait. Magazines should be available to help pass the patient's time.

pharmacy dis. Space in the Outpatient Pharmacy

The outpatient pharmacy personnel are extremely handicapped by lack of space. Bulk stock, stock bottles, and passouts are conveniently located, and the shelf system is oriented to the activities of the pharmacists. The height of the shelf system extends upward to the limit of the shorter pharmacists, and there is no room for safe positioning of a step to permit higher shelving. The key problem is lack of space to accommodate more than five pharmacists without decreasing total capability.

The space problem could be alleviated by moving selected shelving to available areas within the existing outpatient pharmacy (see Appendix G). This would permit as many as five pharmacists, in addition to the typist, to function efficiently.

The amount of available space between the inwindow and the outwindow in the existing layout is so limited that installing an automated system for moving completed work away from the filler and to the dispensing pharmacist would be of minimum benefit.

Many problems could be reduced or eliminated through the use of automatic data processing. While most hospital data-processing systems are concerned with inpatient functions, the following automated functions relate to outpatient

pharmacy dispensing:

1. Computer disc storage of records of all persons who have been treated in the past five years.
2. Record storage of all medications received by each patient.
3. Computer disc storage of information on all formulary drugs to help the physician determine availability of the prescribed drug in the proper strength and dosage form.<sup>5</sup> This would, in turn, save corrective action by the pharmacist.
4. Record of drug allergies or sensitivities of the patients to indicate potential reactions.
5. Record of combinations of separately prescribed pharmaceuticals which indicate potential for adverse reaction when taken within a short time frame.
6. Transmittal of prescription direct from the clinic and, if not rejected by the computer because of select criteria, label and record printout automatically typed.

By utilizing an information-processing system to enter and retrieve outpatient pharmacy data, up-to-date information is made available to the pharmacy for better planning and manual retrieval for monthly reports is eliminated.<sup>6</sup> Economic operation and better patient care continue

to be the goals of hospitals.<sup>7</sup> ADP can help achieve these goals.

Ancillary personnel added to the outpatient pharmacy in order to fill prescriptions would be of benefit until the total of ancillary personnel and pharmacists reached five. Then it would be necessary to remove any one type when the other type arrived because space is so critical.

Unclaimed pharmaceuticals present a storage problem. When pharmaceuticals are ready to be dispensed and the outpatient does not respond, the prescriptions must be removed from the pharmaceutical queue on the pharmacy side of the outwindow. The unclaimed prescriptions are removed to make room for more prescriptions and must be stored elsewhere, but they must be made available when the outpatient calls for them. This storage problem is minimized when the outpatient queue is sufficiently short to induce the outpatient to remain in the outpatient pharmacy waiting room.

Prepackaged pharmaceuticals may be considered here. The package workload, which can be shifted from times when the outpatient load is greatest, will contribute greatly to a reduction of outpatient pharmacy queues.

While it is good training to rotate pharmacists throughout the various functions within the outpatient

pharmacy, the most efficient combination of pharmacists should be sought during confrontation with peak outpatient loads.

A satellite outpatient pharmacy may be a consideration; however, it is apparent that two outpatient pharmacies could increase the pharmacists' total idle time during slack periods. It would also seem reasonable that one centralized outpatient pharmacy which is sufficiently large and which contains a double outwindow would benefit from economies in stock, typing, inwindow service, and resident training applications, as well as offer space for maneuverability.

Therefore, a satellite pharmacy is not an efficient solution to the problem at hand.

The two service counters in the outpatient pharmacy limit the number of pharmacists that may simultaneously service the outpatients. It would be practical to modernize the outwindow by removing the old-fashioned moviehouse-style ticket window, the opening of which is too high for short patients and too low for tall patients to speak through with clarity.

Some of the pharmacists' time is consumed at the inwindow handing out printed information which is not directly related to the pharmacy and which could be handed to the outpatient in the clinics or placed in a box by the waiting

room door (see Appendix H).

The intercom system was inoperative throughout the week the writer was present in the outpatient pharmacy and reportedly was frequently inoperative. The intercom should be in a continuous state of good repair to insure optimum communication between the pharmacist and the outpatient.

( $Q_2 = R+T+F+C+D+T_h$ , where  $Q_2$  is patient waiting time at the outwindow;  $T$ ,  $T$ ,  $F$ ,  $C$ ,  $D$  are times at each function; and  $T_h$  is holding time when the prescription is in the queue on the pharmacy side of the outwindow.) All wasted time during function  $D$  not only adds to the waiting time of the group of prescriptions being handled but also adds to the waiting time of each group of prescriptions thereafter, until all prescription backlog has been removed during the holding time. (See Appendix I.)

The typist position is presently manned by a pharmacist. It should be manned by a trained typist. While the position may be dull and unchallenging, a rotation schedule should be established so that selected typists throughout the pharmacy can rotate in assignments. Pay, desk, and typewriter improvements would greatly enhance the position.

The primary reason for having a typist occupy the typist position is to permit the pharmacist to function as a

pharmacist. This would permit routinely higher staffing of the pharmacy.

One is concerned about outpatient pharmacy queueing theory because of compassion for people. One is concerned about their emotional as well as their mental and their physical well-being or one would not be in the health care field. The satisfaction that accompanies a short wait at the outpatient pharmacy as opposed to the dissatisfaction that accompanies a long wait is a relative thing. What may seem like a short time to one person may seem like a long time to another person.

A util will be assigned as a measure of satisfaction: 1.0 utils indicate complete satisfaction; 0 utils indicate neutral satisfaction; and -1.0 utils indicate complete dissatisfaction. (See Appendix I.) As the outpatient pharmacy queue lengthens, the utils decrease. Notice that the satisfaction in the positive area decreases at an increasing rate until neutral emotion is bypassed, and then dissatisfaction increases at a decreasing rate. After a certain queue length is reached, dissatisfaction is very high. If the patient were at a gas station or in a movie line, he would simply get out of the line and go elsewhere. However, a sick individual must obtain the medicine necessary to get well.

In seeking to establish a desired length for the outpatient pharmacy queue, the objective must be a reduced waiting period, which will result in a point on the axis to the left of the point of neutral emotion, in the direction which merits greater utility.

### Pharmacy Workload

While the hospital patient census has plateaued in recent years, the outpatient pharmacy workload has increased. The fiscal year 1969 average daily patient load was 310, down from 325 in fiscal year 1968, and there were 130,000 outpatient visits in fiscal year 1969, down from 145,000 in fiscal year 1968. This down trend contrasts to the 132,487 outpatient pharmacy prescriptions and requisitions filled in fiscal year 1969, up 16.5 per cent from 113,680 in fiscal year 1968.

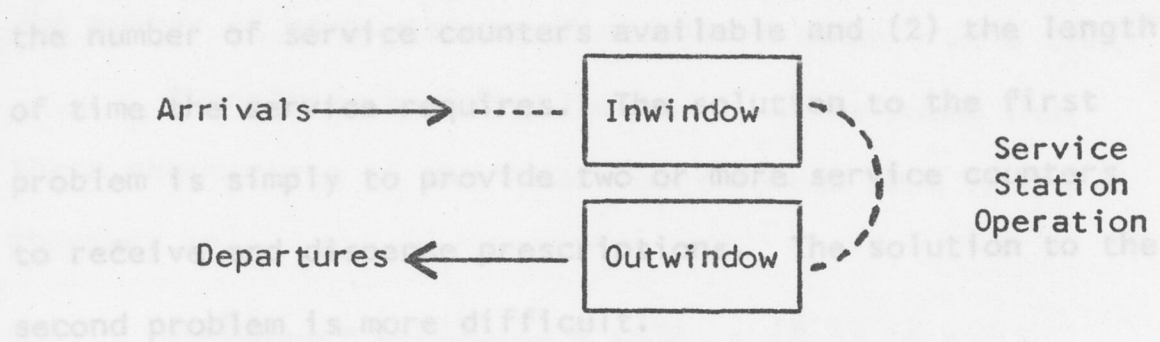
It is very likely that the outpatient pharmacy prescription and requisition workload will increase throughout fiscal years 1970 and 1971, to exceed fiscal year 1969, as medical science develops more wonder drugs and more people become aware of their "medical right."

This growing source of pharmacy outpatients and the growing number of pharmaceuticals available to these outpatients could conceivably overload any given outpatient

pharmacy.

The word queue is a French word meaning "waiting line."<sup>8</sup> People queue up or form a queue for service at the outpatient pharmacy. Prescriptions are considered to form a queue wherein the outpatient is merely a means of transportation for one, two, or more prescriptions. After a prescription is received at the pharmacy window, it is added to another queue at the typewriter while a label is typed for the prescription's intended container. Another queue is formed while each prescription waits to be picked up by the outpatient. At the same time, the outpatients form their own queue, waiting for their one or more prescriptions to be filled, even though the outpatients may actually be sitting or pacing the floor or waiting elsewhere in the hospital. There are three basic elements in terms of which the outpatient pharmacy system can be described: (1) the distribution of arrivals (the input process), (2) the service mechanism, including the distribution of service times, and (3) the queue discipline.<sup>9</sup> The outpatient pharmacy operation may be schematically simplified as follows:

The service mechanism contains two problems: (1)



The arrival times of outpatients bearing prescriptions are irregular and scattered over the normal duty hours of the outpatient pharmacy (8:30A.M. to 4:30P.M.).

The outpatients may be generally considered as coming from outside the hospital, such as walk-ins seeking refills, or as coming from one of 27 clinics within the hospital with a prescription from a doctor. (See Appendix J for outpatient appointment time schedule.)

The way in which outpatients in the queue are served when they reach the inwindow is called "queue discipline." Queue discipline is on a first-come, first-served basis with exceptions. The exceptions are: (1) emergencies, (2) outpatients holding children under one year of age, and (3) employees of the hospital. These exceptions do not affect the total time that the pharmacist spends filling prescriptions in one day but do affect, minutely, each outpatient already queued up, to receive his or her pharmaceutical.

The service mechanism contains two problems: (1)

the number of service counters available and (2) the length of time the service requires. The solution to the first problem is simply to provide two or more service counters to receive and dispense prescriptions. The solution to the second problem is more difficult.

### Staffing of the Outpatient Pharmacy

The number of pharmacists that may work in the outpatient pharmacy at one time may vary from one to five. A minimum of one pharmacist is required to work during normal duty hours. Because of the small size of the pharmacy, five is considered to be the maximum number of pharmacists that may work efficiently at one time. The average number of pharmacists that worked during the sample week was three. The fourth and the fifth pharmacists were added after the outpatient queue became intolerably long.

It must be noted that there are fourteen pharmacists who may be assigned to fill the average three positions in the outpatient pharmacy. According to Theorem E, the number of ways in which  $r$  objects can be selected from a set of  $n$  distinct objects is:

$$\frac{n(n-1) \times \dots \times (n-r+1)}{r!}$$

or:

$$\frac{n!}{(n-r)!r!}$$

the number of combinations of  $n$  objects taken  $r$  at a time.<sup>10</sup>

Therefore, applying Theorem E, it is found that three pharmacists of the total fourteen can work in the pharmacy in:

$$\frac{n!}{(n-r)!r!} = \frac{14!}{(14-3)!3!} = \frac{14!}{11!3!} = \frac{14 \cdot 13 \cdot 12}{3 \cdot 2 \cdot 1} =$$

$$14 \times 13 \times 2 = 364$$

This means there are 364 possible combinations of three pharmacists out of the total 14 available to work. With this potential, it is considered that any three randomly selected pharmacists are as efficient as any other similarly selected three pharmacists.

If too many pharmacists are on duty at one time in the outpatient pharmacy, time is wasted. In queueing theory, there are two costs which are directly related and relevant to the objective of minimizing overall costs. These are the costs of service idle time and waiting line time. The pharmacists excess to the number of three are permitted, when the queues shorten, to return to the inpatient pharmacy to perform inpatient pharmacy duties. Therefore, the number of pharmacists fluctuates throughout the duty day.

The outpatients, on the other hand, indicate almost no waiting line costs. Interviews were conducted for 60 minutes on each of two occasions (Appendix K), the times

being determined by drawing random numbers. The results are shown in Table 1 below

TABLE 1  
RESULTS OF PATIENT INTERVIEWS

Item	First Interview	Second Interview	Total
Number of outpatients interviewed	55	26	81
Number outpatients employed	18	11	29
Percentage of outpatients employed	. .	. .	35.8%
Number outpatients with lost wages	1	0	1
Percentage of outpatients with lost wages	. .	. .	1.2%
Average cost per hour	\$3.06	. .	\$3.06

The above table illustrates that 1.2 per cent of the outpatients sampled were realizing actual dollar loss because of remaining in the queue.

The writer's concern is the satisfaction achieved by each outpatient from having a relatively short wait for pharmaceuticals after the prescription has been released to the pharmacist. Any queue may be considered too long by the outpatient, but there must be a balance struck among the pharmacists, the outpatients, and the number of

prescriptions being presented by each outpatient.

At mid-morning, the total outpatient pharmacy duty operating staff is given relief by other pharmacists in order to take a coffee break. This break in continuity, however minimal, comes at a time when the queues are beginning to build. Each minute lost during the queue buildup at or near 10:00A.M. is added to each outpatient's waiting time until the queue dissipates, normally between 1:00 and 1:30P.M.

The desired queue length must be determined with due consideration for the capacity of the outpatient pharmacy and in relation to the number of prescriptions arriving within a given time frame.

A prescription was traced as it was received at the inwindow and was processed through the five basic stages: (1) receipt of the prescription, (2) typing of the prescription data onto the label, (3) filling the prescription, (4) checking of the labeled prescription, (5) dispensing the prescription. Stages 1, 4, and 5 must be performed only by a pharmacist. Stages 2 and 3 may be performed by a pharmacist or by a trained technician. A flow diagram exemplifies the prescription receipt-transpose-fill-verify-dispense operation, with decision points and alternate actions indicated (Appendix L).

All prescriptions for a single patient are maintained as a group. This policy enhances precision and minimizes error. Further, each group of prescriptions must be typed together, placed in bins or on the counter together, filled together, and checked together. When the checker has completed a given group of prescriptions, all stock bottles must be returned to their source shelf before proceeding to the next group of prescriptions. It is within the series of functions of filling, checking, and dispensing that automation could be used to advantage to maintain prescription groupings in their respective order as they move along behind other prescription groupings.

Pharmacy, as practiced within the hospital, is a profession involved in managing a hospital department. Applications of industrial engineering to the pharmacy have included prepackaging of drugs; improvements in systems, equipment, and facilities; forms design and control; standardization of methods; and make or buy alternatives for the medication administered by syringe.<sup>11</sup>

#### Queueing and Related Statistics on the Outpatient Pharmacy

The function of model building and analysis is not to replace intuition and judgment but rather to support

them with tools for handling degrees of complexity and uncertainty with which human intuition cannot cope unaided. In using these modern techniques, the statistician--and management--must never forget that statistical conclusions drawn from the analysis of data should always be checked against logic.<sup>12</sup>

In order to discuss a queueing system, the arrival and the service pattern must be specified. If arrivals are not scheduled, it is reasonable to assume they are random. The chance of the next arrival's occurrence is independent of the time that has elapsed since the last arrival. If  $h$  is a sufficiently small amount of time and  $\lambda$  is the mean rate of arrivals (i.e.,  $\frac{1}{\text{the mean time between arrivals}}$ ), the probability of an arrival in the interval  $t$  to  $t+h$  is  $\lambda h$  independent of the time  $t$ .<sup>13</sup>

This distribution of arrivals is called poisson. It may be shown that the probability of  $n$  arrivals in any finite interval of time,  $t$ , is  $\frac{e^{-\lambda t} (\lambda t)^n}{n!}$ .

While the arrivals at the outpatient pharmacy are essentially poisson, the queues are influenced, in part, by the earlier scheduling of a predominant number of outpatients at the various clinics. Walk-in outpatients

wanting refills comprise 12 per cent of the pharmacy outpatients. That leaves 88 per cent arriving from the clinics.

A queue may be said to have developed when outpatients are waiting for their prescriptions to be filled, even though they may be seated and reading a newspaper or walking after a cup of coffee. The queue is in existence when people cannot depart because of their unfinished business with the outpatient pharmacy. A physical line containing people, standing, one behind the other, at the window, outwindow, is not necessary.

A survey of the outpatient pharmacy operation was made over a 5-day period. (Refer to Appendix B for compiled data.) The survey was accomplished to determine the average time the outpatient waited to present his prescription(s) to the pharmacist and the average time that the outpatient waited for his prescription(s) after the pharmacist had received them. It was also decided by the writer that it should be determined how much time, on the average, each prescription required.

The outpatient queue at the outwindow was plotted on graph paper to visually portray the week's workload. The weather was clear and sunny, presenting no detriment to potential outpatients. One day reportedly had a heavier

than normal workload, and another had a reportedly light workload. The clinic source was color coded to reflect significant trends; however, this color coding will not be apparent on the reproduction (Appendix B) because of photographic reproduction limitations.

The statistics showed that the average outpatient arriving at the outpatient pharmacy: (1) arrived every 2 minutes, 20 seconds, (2) carried 1.88 prescriptions, (3) waited 2 minutes, 15 seconds, in the queue at the inwindow, (4) had his prescriptions processed by three pharmacists (one of whom typed labels), and (5) waited 23 minutes, 48 seconds, in the queue at the outwindow.

A retest was conducted from 9:30 to 10:30A.M. on Wednesday, April 22, 1970, and Friday, April 24, 1970.

Results showed an average of 31 outpatients carrying 61 prescriptions for a ratio of 1.97 prescriptions per each outpatient.

While the arrivals are poisson in nature, there is correlation with the clinic's initial hours of operation.

There may be a brief queue when the pharmacy opens at 8:30A.M. This queue shortens immediately but begins to grow significantly near mid-morning. The queue at this time will maintain its length unless handled by five pharmacists.

Inspection of the plotted data permitted the writer to select four 30-minute periods from the sample week which indicated trends toward increased queue lengths. This data, depicted in Table 2, revealed that: (1) an insufficient number of pharmacists was utilized for at least thirty minutes despite an obvious trend toward a longer outpatient queue and (2) five pharmacists, considered to be the maximum number that can function efficiently within the small outpatient pharmacy, handled prescriptions at the rate of ninety-eight per hour and had the queue increase from a 40-minute wait to a 54-minute wait.

TABLE 2

## SELECTED OUTPATIENT QUEUES

No. of Phrmst	No. of Prspts	Prescript Rate/Hour	Start Queue Length	End Queue Length	Amt of Increase
2	39	78	:12	:55	:43
2	50	100	:24	:59	:35
3	56	112	:18	:56	:38
5	49	98	:40	:54	:14

NOTE: A colon (: ) before a number denotes minutes.

The table of selected outpatient queues brings home a major point: While the maximum of five pharmacists could not help but let the queue length grow from a 40-minute wait

to a 54-minute wait, why was the queue allowed to grow to a 40-minute wait before an extra pharmacist was summoned to help? and why were the other queues permitted to jump from 12 to 55 minutes, from 24 to 59 minutes, and from 18 to 56 minutes within a 30-minute period with only 2, 2, and 3 pharmacists, respectively, providing service?

It becomes obvious that, once the outpatient pharmacy achieves a 50-minute queue and the prescriptions are maintained at a 100-prescriptions-per-hour rate, even the full five pharmacists cannot shorten the queue.

As long as there is no pharmacist idle time, any shortening of the outpatient queue because of the use of the maximum number of pharmacists would permit the use of fewer pharmacists at an earlier time in the day.

In queuing situations, problems arise when there is either too much or too little demand upon service facilities. In the former case, there will be an excess of waiting time imposed upon the customers, and, in the latter case, there will be an excess of idleness imposed upon the service facilities.<sup>14</sup> This is not true of the outpatient pharmacy under consideration. When the pharmacists approach a potential idle time situation, all but one may depart the outpatient pharmacy to perform other pharmacy departmental duties

until the outpatient queue lengthens to a prescribed level.

### The System

In the systems approach to improvement, the engineer concentrates upon those aspects of a system which are likely to yield the most beneficial improvements.<sup>15</sup>

If the arrival rate per channel is equal to the service rate per channel, unless the arrivals are spaced regularly at the mean service time, the queue will grow indefinitely.<sup>16</sup> This is due to the fact that unused service time cannot be saved or made up.

Since the capacity of the outpatient pharmacy to reduce queues is directly related to the maximum of five pharmacists that must operate efficiently at the same time, the concern is with that number of prescriptions which equal the service rate by five pharmacists. When that number is constantly surpassed, the queues will lengthen to a point where reduction of the queues will be accomplished long after the end of normal duty hours, and the length of the queues may incur waiting times in excess of three hours.

Undoubtedly, the most important part of planning is predicting, or forecasting, the future values of various key variables on the basis of past data.<sup>17</sup> A more difficult type of forecasting, and one which requires a greater skill

on the part of the pharmacist, is the planning for new or expanded pharmacy services.<sup>18</sup> It is necessary to forecast the fiscal year 1971 outpatient prescriptions and requisitions in order to determine potential queue lengths during that year.

Outpatient prescriptions and requisitions are reported quarterly at the United States Public Health Service Hospital, New Orleans, Louisiana. The writer is concerned primarily with the quarter offering the greatest outpatient pharmacy workload, the second quarter.

The quarter under consideration will be treated statistically for its long-term trend.

2nd Qtr	x	y	xy	x <sup>2</sup>
1968	-1	28,032	-28,032	1
1969	0	31,705	0	0
1970	1	38,139	38,139	1
1971	0	97,876	10,107	2

Substituting  $n = 5$ ,  $\sum y = 97,876$ ,  $\sum xy = 10,107$ , and  $\sum x^2 = 2$  into the formulas for a and b, we get:

$$a = \frac{\sum y}{n} = \frac{97,876}{5} = 32,625$$

$$b = \frac{\sum xy}{\sum x^2} = \frac{10,107}{2} = 5,053$$

The equation for the trend line is written as:

$$y' = 32,625 + 5,053x$$

(Origin, 1969; x units, 1 year; 2nd Quarter fiscal year number of prescriptions filled at outpatient pharmacy)

$$2\text{nd Q, FY 71} = a + bx = 32,625 + 5,053 \cdot 2 = 42,731$$

The forecast prescription and requisition total for the second quarter of fiscal year 1971 is 42,731. This is 10 per cent above the second quarter of fiscal year 1970. See Table 3 below.

TABLE 3  
OUTPATIENT PRESCRIPTIONS AND REQUISITIONS  
FISCAL YEARS 1965-1971

Qtr	Fiscal Year						
	1965	1966	1967	1968	1969	1970	1971
1	25,161	28,023	24,975	25,256	31,120	35,688 <sup>a</sup>	41,120 <sup>b</sup>
2	27,072	31,138	23,176	28,032	31,705	38,139 <sup>a</sup>	42,731 <sup>b</sup>
3	28,524	32,951	24,740	30,346	35,133	40,466 <sup>b</sup>	45,662 <sup>b</sup>
4	28,054	27,810	27,128	30,046	34,529	37,968 <sup>b</sup>	41,668 <sup>b</sup>

<sup>a</sup>Adjusted upward 10 per cent for change in FY 70 and FY 71 tally methodology.

<sup>b</sup>Forecast.

Any queueing system which can be described and for which data on arrival and service times can be obtained can be simulated.<sup>19</sup>

The histogram in Appendix M, Fig. 1, indicates the mean patient load each hour of the sample week. The

histogram shown on Fig. 2, Appendix M, illustrates the mean prescription load for each hour during the sample week. Each hour is also expressed as a percentage of the day's total prescription load. This illustration clearly shows the peak load is concentrated between 9:30 A.M. and 12:30 P.M. This configuration also indicates the peak load may be worked off during times of relative lull in the afternoon.

On the same illustration, the average number of prescriptions during each 15-minute period within the hour and the standard deviation for these averages are presented.

In Fig. 3, Appendix M, the histogram illustrates the mean waiting time at the inwindow for each hour of the day. Some distortion is injected into the statistics because of the waiting time caused by outpatients queuing up before the outpatient pharmacy opens--a waiting time over which the pharmacists have no control. This histogram indicates the trend toward shorter inwindow queue length after the peak load is passed.

In Fig. 4, Appendix M, the histogram illustrates the mean waiting time at the outwindow during each hour of the duty day. This is positively skewed and reflects a smoothing action image of the earlier-mentioned prescription load and the patient load histograms.

The histogram shown in Fig. 5, Appendix M, shows a bell-shaped distribution of outpatient pharmacy staffing. It is quite easy to see that the average staffing level is three. Contrast the 13.75 per cent of the time that four or five pharmacists were utilized as opposed to the approximately 33 per cent of the time that outpatients had to wait thirty minutes to over an hour in the queue.

Of special interest are the statistics for April 15, 1970. On this date, 462 prescriptions were processed as compared with the mean of 408 for the week of April 13-17, 1970 (Appendix N). This 13 per cent increase above the mean was reflected in a 21 per cent increase from 9:30 to 10:30 A.M., a 25 per cent increase from 10:30 to 11:30 A.M., a 19 per cent increase from 11:30 A.M. to 12:30 P.M., and an 89 per cent increase from 12:30 to 1:30 P.M. What prevented the day from being a total disaster was the fact that there occurred an 18 per cent decrease in prescriptions from 8:30 to 9:30 A.M. and a 25 per cent decrease from 1:30 to 2:30 P.M.

During this time, the number of pharmacists operating the outpatient pharmacy went from two, at 10:00 A.M., to three, at 10:30 A.M., to four, at 11:00 A.M., to five, at 11:30 A.M.

At 10:00 A.M., the queue length at the outpatient pharmacy outpatients. The clinic waiting room is normally

outwindow was 52 minutes; at 10:30 A.M., it was 53 minutes; at 11:00 A.M., it was 45 minutes; and, at 11:30 A.M., it was 40 minutes. After the 5-pharmacist team had been operating thirty minutes, the queue length had again shot up to 51 minutes.

Management might speculate how the queue length might have been shortened if five pharmacists had confronted the queue when it began to build at approximately 9:30 A.M.

#### The Alternative of Relocation

The alternative to the existing outpatient pharmacy is to move to an area now used as office space by the chief of the pharmacy department and incorporate an adjacent entranceway and further incorporate a small storage room. There are several major negative features about this area which preclude this writer's favor: While the square footage is a little better than the existing location, there are walls which could not be removed in their entirety. The inwindow and the outwindow would face busy corridors, thereby offering congestion and safety hazard. The loss of the existing waiting room would not be compensated for. The peak load for the pharmacy is concurrent with the peak load for the clinics, whose waiting room would have to absorb the pharmacy outpatients. The clinic waiting room is normally

overflowing, precluding any consolidation benefits.

The unusual configuration of the walls would present extreme difficulties to automation considerations of moving pharmaceuticals between the filling and the dispensing functional areas.

Certainly the loss of administrative and storage areas would compound support problems during increased inpatient and outpatient pharmacy activity.

Within the confines of financial limitations, it appears to be in the best interest of the outpatient pharmacy operation to improve management in the existing location rather than spend time and money on another potential problem.

#### Summary

The number of prescriptions filled by the outpatient pharmacy has increased each year since fiscal year 1967.

The outpatient pharmacy queue at the outwindow has grown to the point where some outpatients must wait over one hour for their prescriptions to be dispensed to them.

The typical outpatient arrives at the pharmacy inwindow an average of 2 minutes and 20 seconds after the preceding outpatient arrived there. He then waits an average of 2 minutes and 15 seconds in the queue at the window. He

hands one of three pharmacists an average 1.88 prescriptions and then waits an average of 23 minutes and 48 seconds in the queue at the outwindow to receive his completed prescriptions. The waiting room is small and unattractive. It contains fifteen seats and is devoid of color, decoration, and reading material. At the average rate of prescriptions (1.88) per outpatient, the fifteen seats permit a backlog of 28.2 prescriptions. At the highest average outpatient load per hour, 37 during the peak hour, this permits each patient a 24-minute wait while seated. If an outpatient must wait for a prescription for a long period of time, there is no incentive for that outpatient to spend his waiting time in the waiting room. This, in turn, causes the pharmacist, on many occasions, to waste time calling the outpatient's name, only to set the pharmaceutical aside where it is quickly retrieved when the outpatient appears. The inwindow frequently has a queue extending into the hallway, causing added congestion and blocking the doorway. This outpatient pharmacy is undersized for the pharmaceutical functions of receiving, typing, filling, checking, and dispensing. The shelving efficiently holds the pharmacy

stock but projects to within a short distance of the work counter, leaving minimum space for maneuverability when more than two pharmacists are working. The outside wall of the outpatient pharmacy includes two windows and shelfless wall space between the windows.

The outpatient pharmacy is without benefit of automatic data-processing equipment to aid in management planning and reporting.

Temporarily unclaimed pharmaceuticals create storage space need and cause wasted time in calling the outpatient and moving the pharmaceuticals an extra time. Frequent downtime on the intercom system necessitated extra vocal effort in order to page outpatients.

The excessive queue times caused 1.2 per cent of the outpatients to lose money. Outpatient satisfaction is the primary reason for reducing outpatient pharmacy queue length.

The outpatient pharmacy is staffed by three pharmacists 72.5 per cent of the time. Outpatient pharmacy out-window queues are 30 to 60 minutes approximately 33 per cent of the time. The pharmacy is staffed by four pharmacists 12.5 per cent of the time and five pharmacists 1.25 per cent of the time.

Of the three pharmacists normally staffing the

pharmacy, one performs the typing function. Two function as pharmacists. The label typing is accomplished by pharmacists whose label-typing abilities vary significantly.

#### Footnotes

<sup>1</sup>Clifford E. Hynniman and Peter P. Lamy, "Outpatient Pharmacy Automation," American Journal of Hospital Pharmacy, XXIV (January, 1967), 18.

<sup>2</sup>Logan, "A Pharmacy 'Room-Stretcher,'" p. 26.

<sup>3</sup>Hildegarde Streufert and Carl Streufert, "How Color Affects Patients' Responses," Hospital Progress, LI (April, 1970), 28.

<sup>4</sup>Ibid., p. 29.

<sup>5</sup>Hynniman and Lamy, "Outpatient Pharmacy Automation," p. 19.

<sup>6</sup>Edward E. Madden, Jr., and Ronald H. Dreyfus, "Outpatient Pharmacy Prescription Automation," American Journal of Hospital Pharmacy, XXV (January, 1968), 24.

<sup>7</sup>Edward E. Madden, Jr., Carol M. Vaughan, and Gerald J. Trahan, "Outpatient Pharmacy Prescription Automation," American Journal of Hospital Pharmacy, XXVI (March, 1969), 159.

<sup>8</sup>U. S., Brooke Army Medical Center, Medical Field Service School, Operations Research for the Health Care Administrator, by Martin P. Wanielista (Fort Sam Houston, Tex.: Medical Field Service School, n.d.), p. 116.

<sup>9</sup>John E. Freund and Frank J. Williams, Elementary Business Statistics: The Modern Approach (Englewood Cliffs: Prentice-Hall, Inc., 1964), p. 410.

<sup>10</sup>Ibid., p. 102.

<sup>11</sup>Harold E. Smalley and John R. Freeman, Hospital Industrial Engineering (New York: Reinhold Publishing Co., 1966), p. 176.

<sup>12</sup>Franklin A. Lindsay, New Techniques for Management Decision Making (New York: McGraw-Hill Book Co., Inc., 1963), pp. 9, 27.

<sup>13</sup>Russell L. Ackoff and Maurice W. Sasieni, Fundamentals of Operations Research (New York: John Wiley and Sons, Inc., 1968), p. 253.

<sup>14</sup>Smalley and Freeman, Hospital Industrial Engineering, p. 343.

<sup>15</sup>Ibid., p. 173.

<sup>16</sup>Ackoff and Sasieni, Fundamentals of Operations Research, p. 254.

<sup>17</sup>Freund and Williams, Elementary Business Statistics, p. 320.

<sup>18</sup>Ackoff and Sasieni, Fundamentals of Operations Research, p. 253.

<sup>19</sup>Ibid., p. 263.

6. Eliminate the unnecessary information sheet

handouts at the inwindow. CHAPTER III

7. Provide a comfortable environment in the outpatient pharmacy waiting room, including pictures, curtains, colors, and magazines. Conclusions

The best method of shortening the queue in the outpatient pharmacy of the United States Public Health Service Hospital, New Orleans, Louisiana, is to:

1. Relocate the selected shelving, the first sections of each of three rows of shelving, to the available outside wall space (Appendix G).

2. Insure that the typist position is occupied by a typist.

3. Utilize a minimum of three pharmacists, in addition to the typing position, when the queue achieves a length of 15 minutes between 9:30 A.M. and 1:30 P.M. and at other times as required.

4. Utilize a minimum of four pharmacists, in addition to the typing position, when the queue achieves a length of 20 minutes between 9:30 A.M. and 1:30 P.M. and at other times as required.

5. Insure that the intercom system works at all times.

6. Eliminate the unnecessary information sheet handouts at the inwindow.

7. Provide a comfortable environment in the outpatient pharmacy waiting room, including pictures, curtains, colors, and magazines.

8. Reverse the inwindow and the outwindow positions in order to locate the inwindow queue around the perimeter of the waiting room. Related functions should be relocated near the inwindow.

9. Remodel the inwindow to include a larger communication opening and a larger service counter.

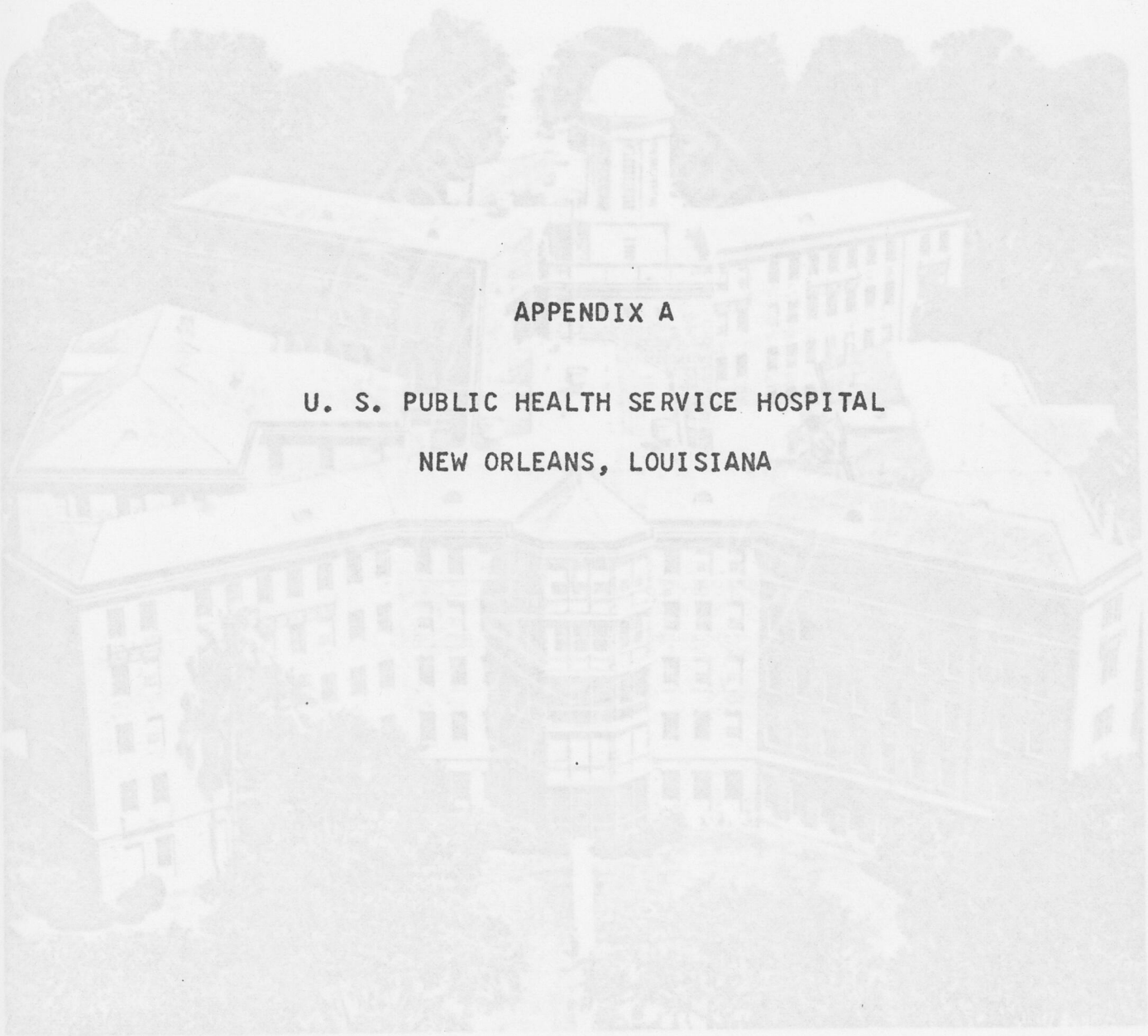
U. S. PUBLIC HEALTH SERVICE HOSPITAL

#### Recommendations

It is recommended that each of the conclusions outlined in the above section be approved and implemented in the priority listed.

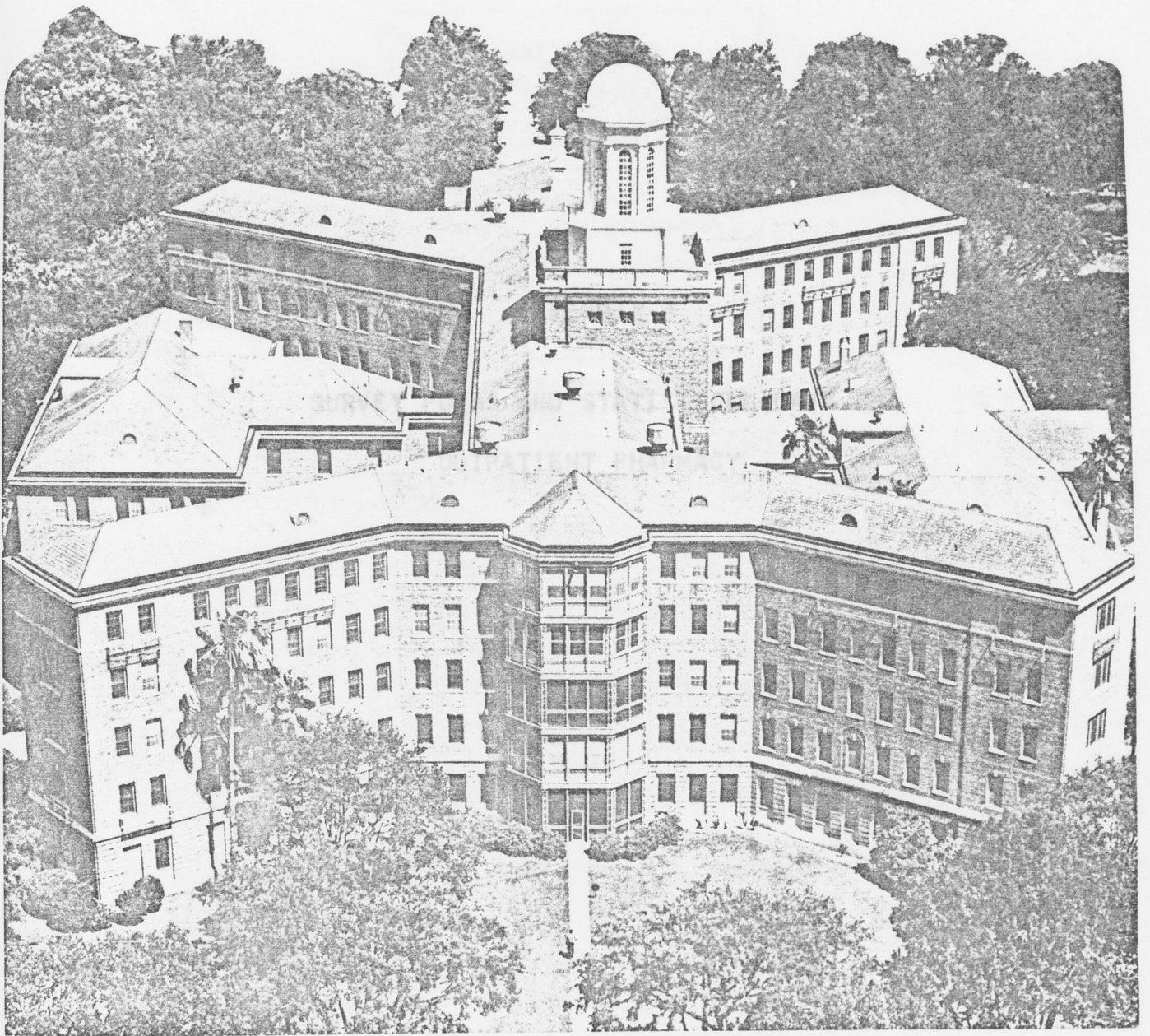
It is further recommended that a study be made to determine the effectiveness of five and six pharmacists during peak outpatient loads, in addition to the typist position, after the selected shelving has been relocated.

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APPENDIX A

U. S. PUBLIC HEALTH SERVICE HOSPITAL  
NEW ORLEANS, LOUISIANA



SURVEY FORM

PLEASE PRINT

Time Not Waited? \_\_\_\_\_

Clinic Source? \_\_\_\_\_

\_\_\_\_\_

No. of Prescript? \_\_\_\_\_

Time Prescription Submitted? \_\_\_\_\_

\_\_\_\_\_

Time Prescription \_\_\_\_\_

APPENDIX B

SURVEY FORMS AND STATISTICAL DATA ON  
 OUTPATIENT PHARMACY

MON

TUE

WED

THU

56

FRI

8:30

This is a photograph reproduction of a color coded 4' x 3' graph used by the writer to determine statistical trends. Color reproduction was not practical.

SURVEY FORM

PLEASE PRINT

Time Pnt Waited? \_\_\_\_\_

Clinic Source? \_\_\_\_\_

\_\_\_\_\_

No. of Prescript? \_\_\_\_\_

Time Prescription Submitted? \_\_\_\_\_

\_\_\_\_\_

Time Prescription Completed? \_\_\_\_\_

\_\_\_\_\_

12:00

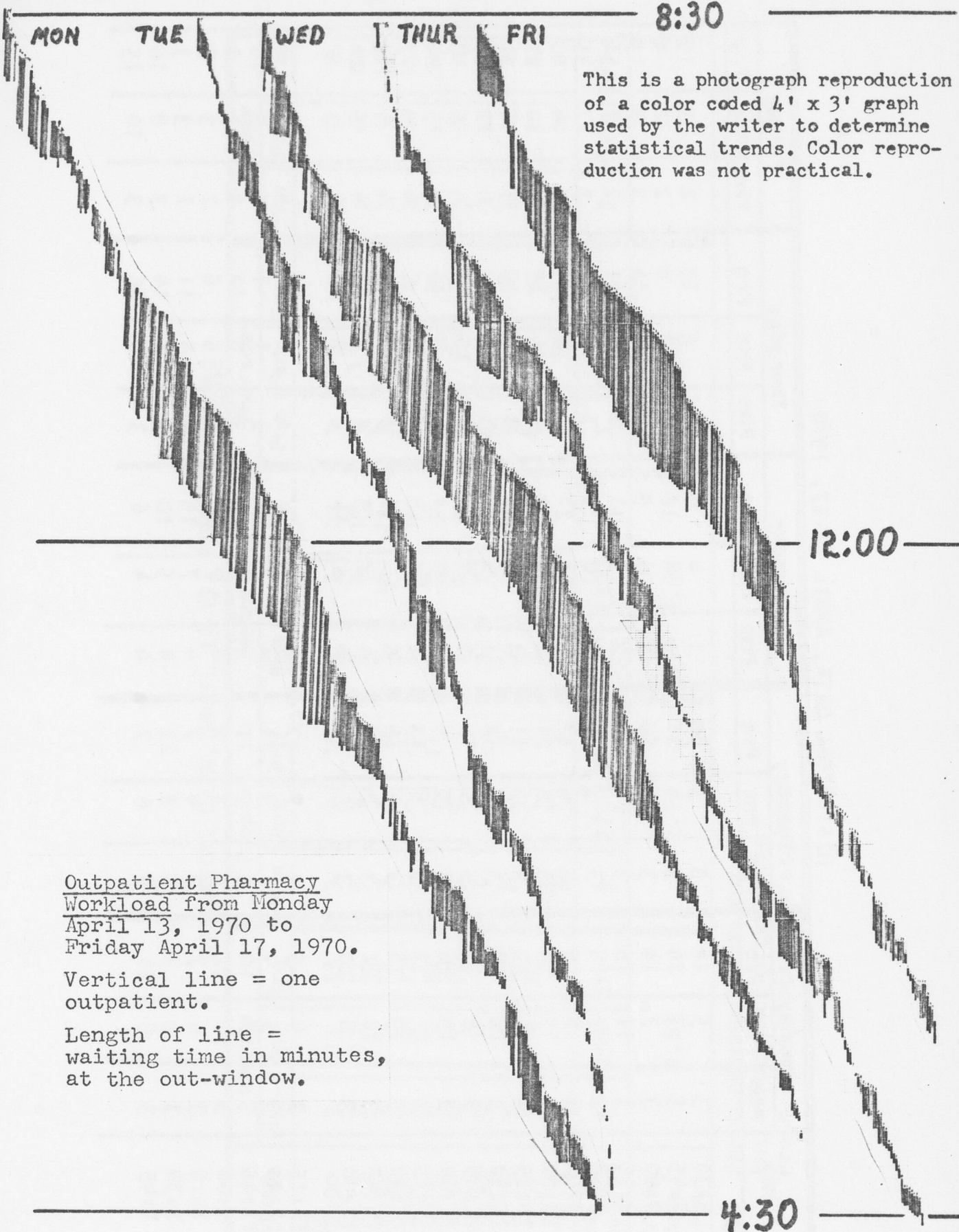
Outpatient Pharmacy  
Workload from Monday  
April 13, 1970 to  
Friday April 17, 1970.

Vertical line = one  
outpatient.

Length of line =  
waiting time in minutes,  
at the out-window.

4:30

8:30



This is a photograph reproduction of a color coded 4' x 3' graph used by the writer to determine statistical trends. Color reproduction was not practical.

Outpatient Pharmacy  
Workload from Monday  
April 13, 1970 to  
Friday April 17, 1970.

Vertical line = one  
outpatient.

Length of line =  
waiting time in minutes,  
at the out-window.

4:30

HISTORICAL DATA, APRIL 13-17, 1970

Times	Monday			Tuesday			Wednesday			Thursday			Friday		
	Phm	Pnt	Pre	Phm	Pnt	Pre	Phm	Pnt	Pre	Phm	Pnt	Pre	Phm	Pnt	Pre
AM:															
8:30	3	5	14	3	5	10	1	4	6	2	5	13	2	9	19
8:45	3	7	14	3	4	11	1	8	16	2	2	6	2	2	4
9:00	3	7	14	3	4	10	2	6	9	2	7	16	2	5	13
9:15	3	11	16	3	11	28	2	5	11	2	7	11	2	7	14
9:30	3	7	15	3	3	10	2	10	19	3	10	21	3	17	35
9:45	3	8	9	3	6	17	3	16	37	3	2	4	3	4	10
10:00	2	7	9	3	8	21	2	8	12	3	14	25	3	10	22
10:15	2	14	22	3	7	11	2	9	20	3	7	15	3	16	31
10:30	3	10	18	3	8	12	3	9	26	3	13	23	4	12	23
10:45	3	6	10	3	5	12	3	8	15	3	10	18	4	5	8
11:00	3	13	18	3	5	9	4	8	22	3	8	16	4	13	24
11:15	3	11	23	3	8	13	4	13	18	3	2	2	4	9	17
11:30	3	9	18	3	7	12	5	16	36	3	7	15	4	4	15
11:45	3	12	22	3	7	20	4	8	13	3	7	14	4	9	22
12:00	3	8	20	3	5	12	4	6	14	3	8	14	4	3	7
PM:															
12:15	3	4	5	2	7	17	4	7	9	3	9	26	4	4	9
12:30	3	3	4	2	5	11	4	7	24	3	1	1	2	3	10
12:45	3	7	10	3	5	11	4	6	12	3	6	12	2	1	1
1:00	3	10	12	3	2	2	4	7	19	3	5	6	2	3	5
1:15	3	6	7	3	4	7	4	7	15	3	5	11	2	3	3
1:30	3	3	3	3	9	22	4	5	10	3	6	14	3	8	16
1:45	3	9	11	3	6	7	4	4	6	3	9	16	3	10	15

HISTORICAL DATA, APRIL 13-17, 1970--Continued

Times	Monday			Tuesday			Wednesday			Thursday			Friday		
	Phm	Pnt	Pre	Phm	Pnt	Pre	Phm	Pnt	Pre	Phm	Pnt	Pre	Phn	Pnt	Pre
PM:															
2:00	3	13	13	3	9	18	3	7	10	3	9	13	3	5	8
2:15	3	11	11	3	4	10	3	7	13	3	13	30	3	6	14
2:30	3	9	12	3	3	9	3	12	21	3	8	12	3	9	15
2:45	3	8	12	3	8	16	3	9	16	3	7	8	3	8	15
3:00	4	5	13	3	7	11	3	5	9	3	5	7	3	4	4
3:15	4	9	17	3	2	3	3	8	9	3	2	6	3	0	0
3:30	3	5	9	3	5	10	3	7	8	3	10	12	3	1	1
3:45	3	9	14	3	2	2	3	4	4	3	4	9	3	0	0
4:00	3	7	10	3	1	1	3	0	0	3	5	6	3	1	1
4:15	3	6	8	3	1	2	3	1	1	3	9	16	3	0	0
Daily Aver.	3	259	414	3	173	367	3	239	462	3	222	419	3	189	379
Pres. Rate/ Pnt	1.60			2.12			1.93			1.90			2.00		

CODE: Phm = pharmacist on duty  
 Pnt = patients presenting  
 Pre = prescriptions presented

STAFFING OF THE OUTPATIENT PHARMACY  
APRIL 13-17, 1970

Times	Mon	Tue	Wed	Thr	Fri
AM:					
8:30	3	3	1	2	2
9:00	3	3	2	2	2
9:30	3	3	3	3	3
10:00	2	3	2	3	3
10:30	3	3	3	3	4
11:00	3	3	4	3	4
11:30	3	3	5	3	4
12:00	3			3	4
PM:					
12:30	3	2	4	3	2
1:00	3	3	4	3	2
1:30	3	3	4	3	3
2:00	3	3	3	3	3
2:30	3	3	3	3	3
3:00	4	3	3	3	3
3:30	3	3	3	3	3
4:00	3	3	3	3	3

APPENDIX C

STAFFING OF THE OUTPATIENT PHARMACY

APRIL 13-17, 1970

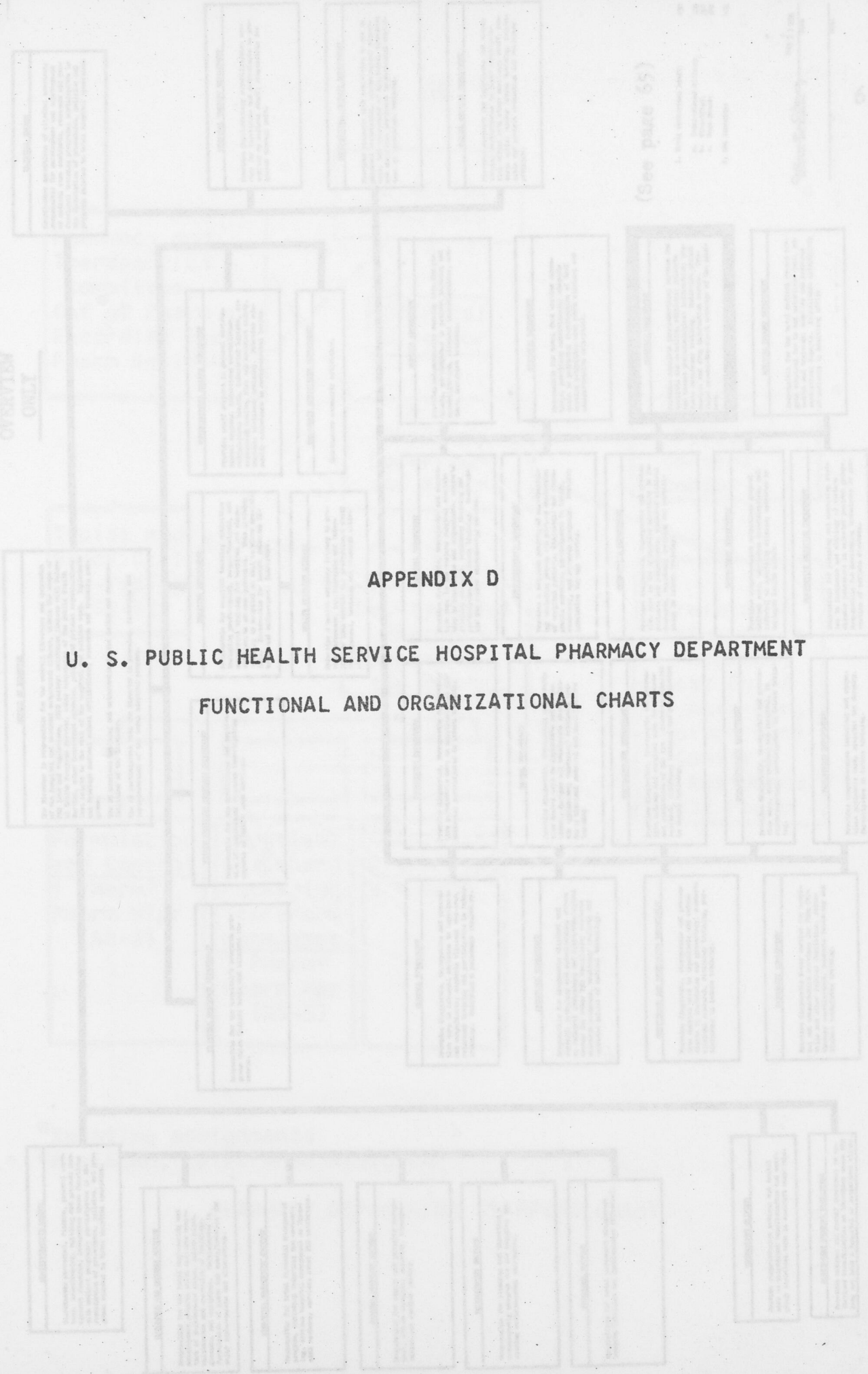
NOTE: Numbers represent the numbers of pharmacists.

STAFFING OF THE OUTPATIENT PHARMACY  
APRIL 13-17, 1970

Times	Mon	Tue	Wed	Thr	Fri
AM:					
8:30	3	3	1	2	2
9:00	3	3	2	2	2
9:30	3	3	3	3	3
10:00	2	3	2	3	3
10:30	3	3	3	3	4
11:00	3	3	4	3	4
11:30	3	3	5	3	4
12:00	3	3	4	3	4
PM:					
12:30	3	2	4	3	2
1:00	3	3	4	3	2
1:30	3	3	4	3	3
2:00	3	3	3	3	3
2:30	3	3	3	3	3
3:00	4	3	3	3	3
3:30	3	3	3	3	3
4:00	3	3	3	3	3

NOTE: Numbers represent the numbers of pharmacists.

FUNCTIONAL CHART  
OPERATION  
ONLY

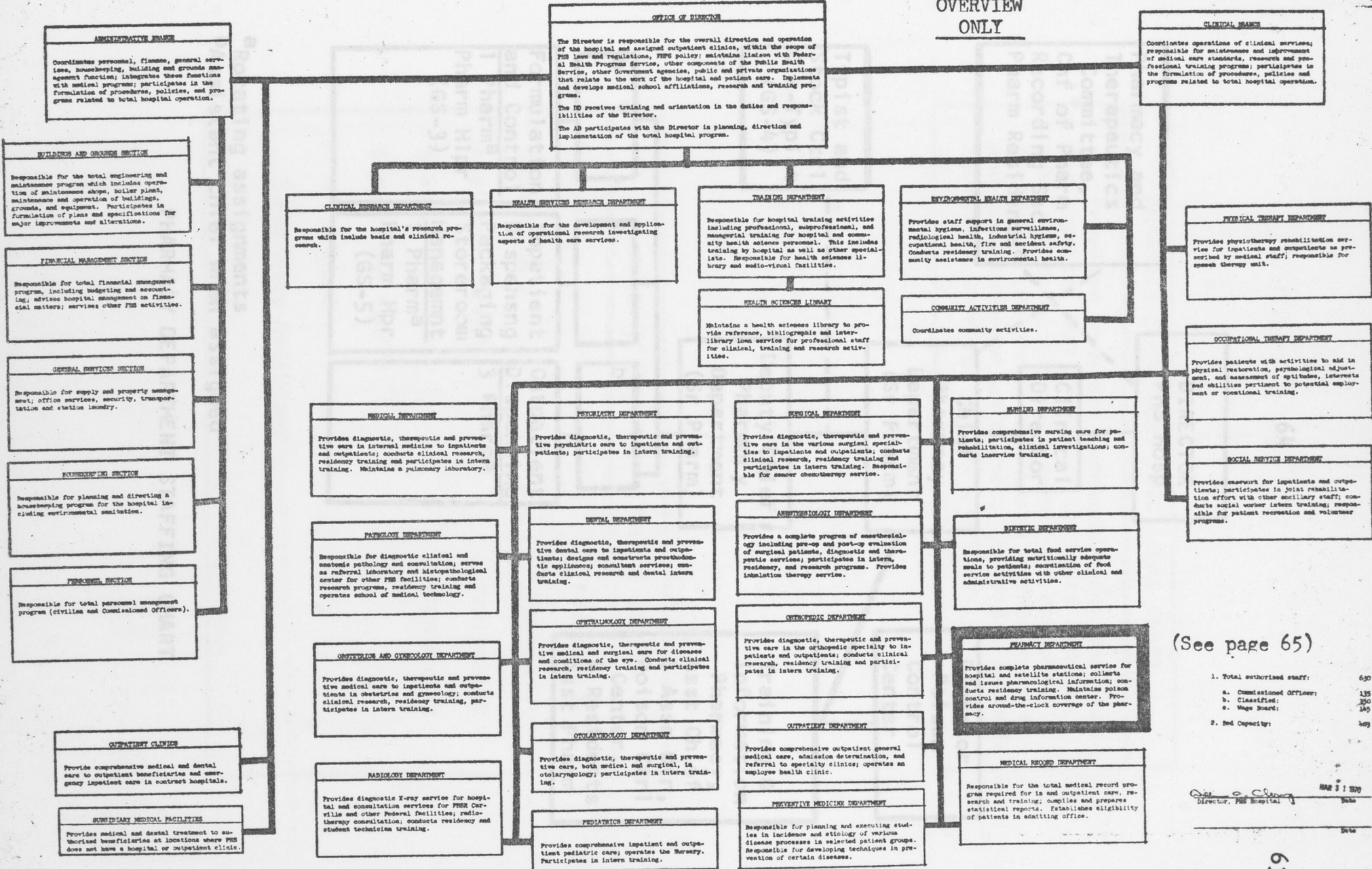


APPENDIX D

U. S. PUBLIC HEALTH SERVICE HOSPITAL PHARMACY DEPARTMENT  
FUNCTIONAL AND ORGANIZATIONAL CHARTS

(See page 65)

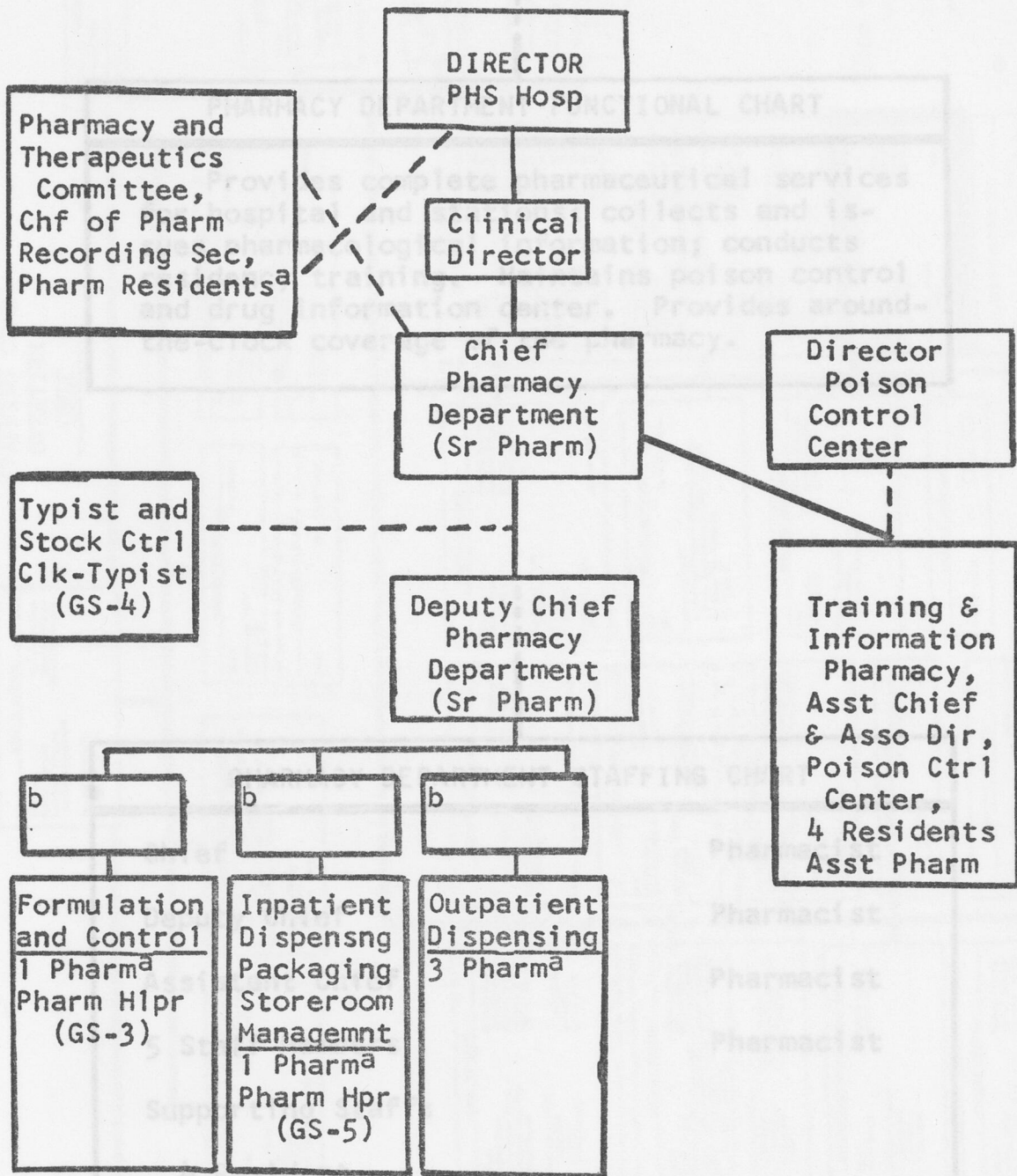
FUNCTIONAL CHART  
OVERVIEW  
ONLY



(See page 65)

- 1. Total authorized staff: 630
- a. Commissioned Officers: 135
- b. Classified: 350
- c. Wage Board: 145
- 2. Bed Capacity: 409

Director, PHS Hospital



<sup>a</sup>Rotating assignments  
<sup>b</sup>Assistant chief when assigned

PHARMACY DEPARTMENT STAFFING CHART

**PHARMACY DEPARTMENT FUNCTIONAL CHART**

Provides complete pharmaceutical services for hospital and stations; collects and issues pharmacological information; conducts residency training. Maintains poison control and drug information center. Provides around-the-clock coverage of the pharmacy.

**PHARMACY DEPARTMENT STAFFING CHART**

<b>Chief</b>	<b>Pharmacist</b>
<b>Deputy Chief</b>	<b>Pharmacist</b>
<b>Assistant Chief</b>	<b>Pharmacist</b>
<b>5 Staff Members</b>	<b>Pharmacist</b>
<b>Supporting Staff:</b>	
<b>4 Resident</b>	
<b>2 Pharmacy Assistant</b>	
<b>1 Clerical</b>	

# STAFFING CHART OVERVIEW ONLY

**OFFICE OF DIRECTOR**  
Director  
Deputy Director  
Associate Director  
for Administration  
08-670-15 NE-847  
08-670-15 NE-847  
08-670-15 NE-847  
Supporting Staff:  
2 Clerical

**ADMINISTRATIVE BRANCH**  
Associate Director  
"for Administration"  
08-670-15 NE-847  
Asst. to Assoc. Director  
for Administration  
08-670-13 NE-795  
Supporting Staff:  
1 Clerical  
2 Clerical (WAS)

**BUILDINGS AND GROUND SERVICE**  
Chief 08-1641-13 NE-591  
Assistant Chief 08-1641-11 NE-617  
Supporting Staff:  
6 Foreman  
6 Operating Register and Fileman  
10 Craftsmen  
3 Laborer  
1 Clerical  
2 Laborer (WAS)

**FINANCIAL MANAGEMENT SECTION**  
Chief 08-505-13 NE-619  
Assistant Chief 08-504-11 NE-593  
Supporting Staff:  
13 Clerical  
1 Clerical (WAS)

**GENERAL SERVICES SECTION**  
Chief 08-342-13 NE-736  
Assistant Chief 08-342-12 NE-737  
Supporting Staff:  
16 Clerical  
1 Telephone Operator  
1 Laundry Foreman  
1 Laundry Lead Foreman  
7 Part-Time and WAS  
4 Storekeeper  
2 Truck Driver  
5 Cook  
13 Laundry Worker

**RECORDKEEPING SECTION**  
Chief 08-673-10 NE-602  
Supporting Staff:  
6 Labor Lead Foreman  
30 Junior  
3 Junior (WAS)

**PERSONNEL SECTION**  
Chief 08-201-13 NE-696  
Assistant Chief 08-201-12 NE-738  
Supporting Staff:  
5 Clerical  
1 Clerical (WAS)

**OUTPATIENT CLINICS**

Location	STAFF	
	Commissioned Officer	Civil Serv.
Jacksonville, Florida	2	4
Memphis, Tennessee	8	18
Mobile, Florida	13	20
Mobile, Alabama	5	15
St. Louis, Missouri	6	9
Tampa, Florida	10	15

**BIODIAGNOSTIC FACILITIES**

Contract Physicians	27
Outpatient Clinics	Canal Zone

**CLINICAL RESEARCH DEPARTMENT**  
Chief Medical Officer  
Deputy Chief Medical Officer  
Supporting Staff:  
1 Chemist  
2 Technician  
1 Clerical  
1 Animal Caretaker (WAS)

**HEALTH SERVICES RESEARCH DEPARTMENT**  
Chief Health Services Officer  
Staff Member Pharmacist  
Program Analyst Health Services Officer  
Systems Engineer Engineer  
Supporting Staff:  
5 Clerical  
1 Clerical (WAS)

**TRAINING DEPARTMENT**  
Chief Sanitarian  
Supporting Staff:  
2 Clerical

**ENVIRONMENTAL HEALTH DEPARTMENT**  
Chief Sanitarian  
Biologist 08-401-7 NE-773  
Supporting Staff:  
2 Resident

**HEALTH SCIENCES LIBRARY**  
Chief 08-1410-10 NE-701

**COMMUNITY ACTIVITIES DEPARTMENT**  
Chief Medical Officer  
Supporting Staff:  
1 Clerical

**CLINICAL BRANCH**  
Clinical Director Medical Officer  
Supporting Staff:  
1 Clerical

**MEDICAL DEPARTMENT**  
Chief Medical Officer  
Deputy Chief Medical Officer  
5 Assistant Chief Medical Officer  
Research Associate Medical Officer  
Staff Member Medical Officer  
Supporting Staff:  
5 Resident  
3 Intern  
3 Technologist  
5 Technician  
4 Clerical  
1 AIA (WAS)

**PSYCHIATRY DEPARTMENT**  
Chief Medical Officer  
1 Staff Member Medical Officer  
Supporting Staff:  
1 Clerical

**SURGICAL DEPARTMENT**  
Chief Medical Officer  
Deputy Chief Medical Officer  
Assistant Chief Medical Officer  
1 Staff Member Medical Officer  
Supporting Staff:  
6 Resident  
4 Supv. Clinical Nurse  
2 Clerical  
Urology Service  
Chief Medical Officer

**NURSING DEPARTMENT**  
Chief 08-610-13 NE-610  
Deputy Chief 08-610-12 NE-544  
Associate Chief (Education) 08-610-11 NE-598  
Supv. Operating Room Nurse 08-610-11 NE-651  
Asst. Supv. Oper. Room Nurse 08-610-11 NE-690  
Supv. Clinical Nurse 08-610-11 NE-649  
Supv. Clinical Nurse 08-610-11 NE-769  
4 Supv. Clinical Nurse 08-610-11 NE-690  
3 Supv. Clinical Nurse 08-610-9 NE-566  
7 Supv. Clinical Nurse 08-610-9 NE-607  
11 Clinical Nurse 08-610-9 NE-711  
1 Clinical Nurse 08-610-9 NE-713  
5 Operating Room Nurse 08-610-9 NE-715  
1 Clinical Nurse Nurse Officer  
Supporting Staff:  
12 Clinical Nurse 14 Clerical  
99 Nursing Assistant 2 AIA  
7 Medical AIA 16 Clinical Nurse and  
1 Ophthalmic AIA Nursing Asst.  
(Part-Time and WAS)

**PHYSICAL THERAPY DEPARTMENT**  
Chief Therapist  
Deputy Chief Therapist  
4 Staff Member Therapist  
Supporting Staff:  
2 Therapy Assistant  
1 Clerical

**OCCUPATIONAL THERAPY DEPARTMENT**  
Chief 08-611-9 NE-618  
Supporting Staff:  
1 Of Assistant (WAS)

**SOCIAL SERVICE DEPARTMENT**  
Chief Health Services Officer  
2 Staff Member Health Services Officer  
Supporting Staff:  
1 Registration Leader  
1 Clerical  
1 AIA (WAS)

**PATHOLOGY DEPARTMENT**  
Chief Medical Officer  
Staff Member Medical Officer  
Medical Technologist (Supv) 08-644-11 NE-240  
Medical Technologist (Supv) 08-644-9 NE-241  
Medical Technologist (Supv) 08-644-9 NE-300  
(Clinical Training)  
Medical Technologist (Supv) 08-644-9 NE-504  
Supporting Staff:  
3 Resident  
1 Intern  
3 AIA  
13 Technologists  
9 Student Technologist  
2 Clerical  
3 Technician (WAS)

**DENTAL DEPARTMENT**  
Chief Dental Officer  
Deputy Chief Dental Officer  
Assistant Chief Dental Officer  
Supporting Staff:  
6 Intern  
1 Clerical  
2 Dental Technician  
7 Dental Assistant

**ANESTHESIOLOGIST DEPARTMENT**  
Chief Medical Officer  
Supporting Staff:  
3 Nurse Anesthetist 08-605-10 NE-506  
1 Nurse Anesthetist 08-605-9 NE-576  
2 Inhalation Therapist  
1 AIA (WAS)

**DIETETIC DEPARTMENT**  
Chief Dietitian  
Deputy Chief Dietitian  
3 Staff Dietitian 08-630-9 NE-441  
Supporting Staff:  
1 West Cutter  
1 Storekeeper  
8 Food Service Supv.  
32 Food Service Worker  
3 Food Service Worker (WAS)  
13 Cook  
3 Clerical

**GYN/STOB AND OBSTETRICS DEPARTMENT**  
Chief Medical Officer  
Staff Member Medical Officer  
Supporting Staff:  
3 Resident  
1 Intern  
2 Clerical

**OPHTHALMOLOGIST DEPARTMENT**  
Chief Medical Officer  
Deputy Chief Medical Officer  
Assistant Chief Medical Officer  
Supporting Staff:  
3 Resident  
1 Clerical  
1 Technician (WAS)

**ORTHOPEDIC DEPARTMENT**  
Chief Medical Officer  
Deputy Chief Medical Officer  
Staff Member Medical Officer  
Supporting Staff:  
4 Resident  
1 Health Technician  
1 Clerical

**PHARMACY DEPARTMENT**  
Chief Pharmacist  
Deputy Chief Pharmacist  
Assistant Chief Pharmacist  
5 Staff Member Pharmacist  
Supporting Staff:  
4 Resident  
2 Pharmacy Assistant  
1 Clerical

**OTOLOGY DEPARTMENT**  
Chief Contract Physician  
Supporting Staff:  
2 Resident

**OTOLOGY DEPARTMENT**  
Chief Contract Physician  
Supporting Staff:  
2 Resident

**OUTPATIENT DEPARTMENT**  
Chief Medical Officer  
5 Staff Member Medical Officer

**MEDICAL RECORD DEPARTMENT**  
Chief 08-609-1 NE-693  
Assistant Chief Health Services Officer  
08-609-4 NE-811  
Supporting Staff:  
20 Clerical  
10 Clerical (WAS)

**RADIOLOGY DEPARTMENT**  
Chief Medical Officer  
Deputy Chief Medical Officer  
Supv. Medical Radiology 08-647-9 NE-595  
Technician 08-1320-9 NE-579  
Supporting Staff:  
6 Resident  
4 Technician  
6 Student Technician  
3 Clerical  
4 Technician (WAS)

**PEDIATRIC DEPARTMENT**  
Chief Medical Officer  
Assistant Chief Medical Officer  
Supporting Staff:  
1 Intern

**PREVENTIVE MEDICINE DEPARTMENT**  
Chief Contract Physician  
Supporting Staff:  
2 Resident  
1 Clerical

(See page 65)

\* Multiple Assignment

1. Total authorized staff: 630  
a. Commissioned Officers: 133  
b. Classified: 390  
c. Wage Board: 185

2. Bed Capacity: 403

Director, PHS Hospital

IDENTIFICATION CARD

U. S. PUBLIC HEALTH SERVICE HOSPITAL  
 210 State St.  
 New Orleans, La. 70118

This card is intended to record purposes only and does not authorize medical care at this hospital. PHONE 385-3341

This card must be provided back from your local hospital.

PRESCRIPTION BLANK AND LABEL

PLEASE PRINT (Last name) (Title) (First name) (Initial)

DATE \_\_\_\_\_

WARDING UNIT OR CLINIC \_\_\_\_\_

AGE IF CHILD \_\_\_\_\_

INPATIENT  
 OUTPATIENT  
 INPATIENT (Discharge)

Gen. or Int.

NO. OF DAYS MEDICATION **APPENDIX E**

Rx

U. S. PUBLIC HEALTH SERVICE HOSPITAL PHARMACY DEPARTMENT  
 IDENTIFICATION CARD, PRESCRIPTION  
 BLANK AND LABEL

PH-588 (Rev. 1-67) PRESCRIPTION BLANK  
 DEPT. OF HEALTH, EDUCATION AND WELFARE  
 PUBLIC HEALTH SERVICE

SOURCE: \_\_\_\_\_

TEST NO. \_\_\_\_\_

LOT NO. \_\_\_\_\_

FILED BY \_\_\_\_\_

CHECKED BY \_\_\_\_\_

\_\_\_\_\_  
*(Signature of provider)*

\_\_\_\_\_  
*(Title of provider)*

Rx

GIVE FULL DIRECTIONS FOR USE

IDENTIFY MEDICATION AND STRENGTH ON PRESCRIPTION LABEL UNLESS CHECKED HERE

AUTHORIZATION IS GIVEN FOR DISPENSING BY NON-PHARMACEUTICAL STAFF UNLESS CHECKED HERE

KEEP OUT OF THE REACH OF CHILDREN

IDENTIFICATION CARD

**U. S. PUBLIC HEALTH SERVICE HOSPITAL**  
 210 State St.  
 New Orleans, La. 70118

This card is intended for record purposes only and does not authorize medical care at Gov't. Expense

PHONE 899-3441

This plate must be presented each time you visit Hospital

PRESCRIPTION BLANK AND LABEL

PLEASE PRINT

(Last name) (Title) (First name) (Initial)

DATE \_\_\_\_\_

NURSING UNIT OR CLINIC \_\_\_\_\_

AGE IF CHILD \_\_\_\_\_

INPATIENT

OUTPATIENT

INPATIENT (Discharge)

Gm. or ml.

NO. OF DAYS MEDICATION IS TO BE USED \_\_\_\_\_

Rx

PHS-583 (Rev. 1-67) PRESCRIPTION BLANK  
DEPT. OF HEALTH, EDUCATION, AND WELFARE  
PUBLIC HEALTH SERVICE

SOURCE \_\_\_\_\_

LIST NO. \_\_\_\_\_

LOT NO. \_\_\_\_\_

FILLED BY \_\_\_\_\_

CHECKED BY \_\_\_\_\_

\_\_\_\_\_  
 (Signature of prescriber)

\_\_\_\_\_  
 (Title of prescriber) USPHS Rx NO. \_\_\_\_\_

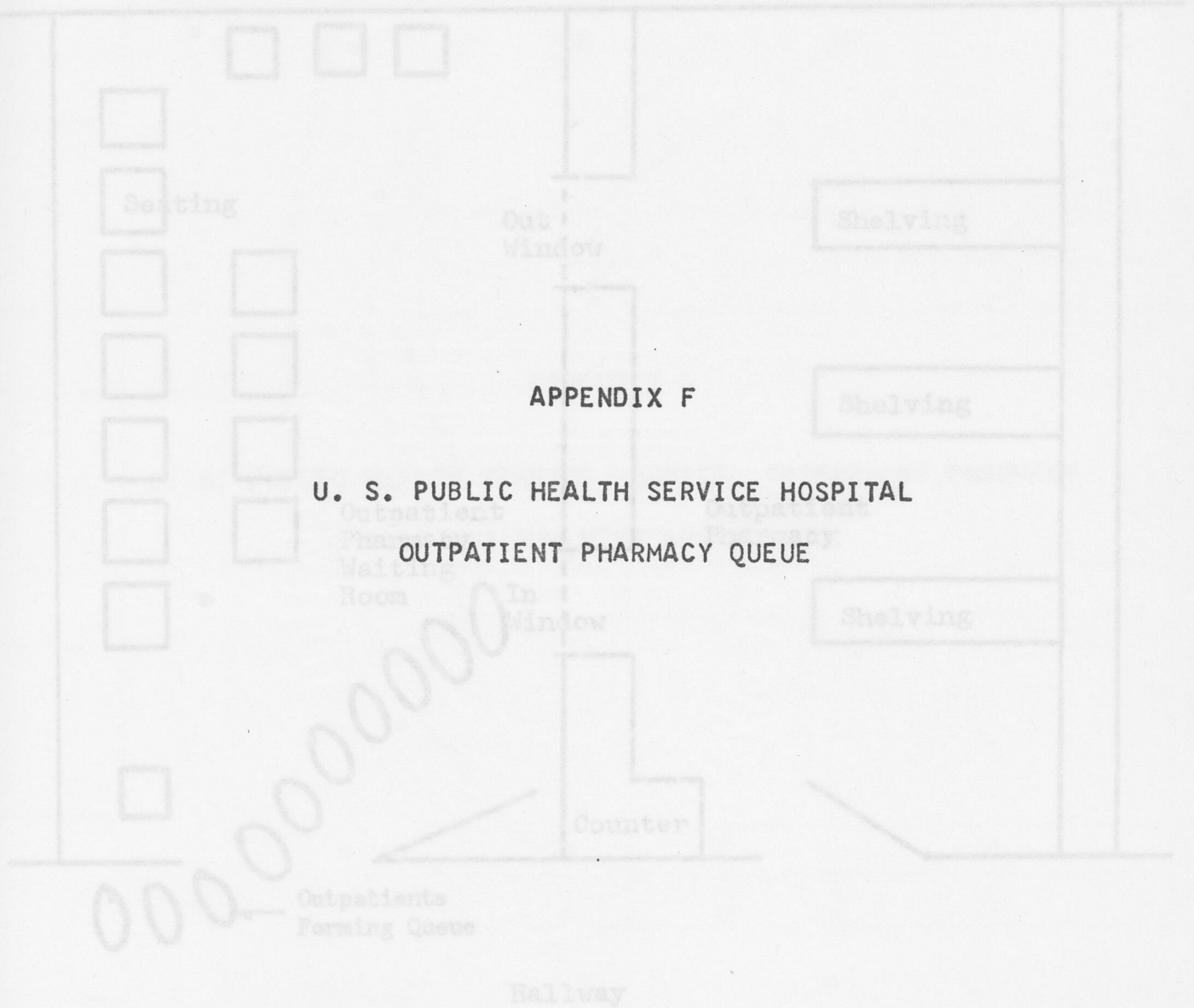
GIVE FULL DIRECTIONS FOR USE

IDENTIFY MEDICATION AND STRENGTH ON PRESCRIPTION LABEL UNLESS CHECKED HERE

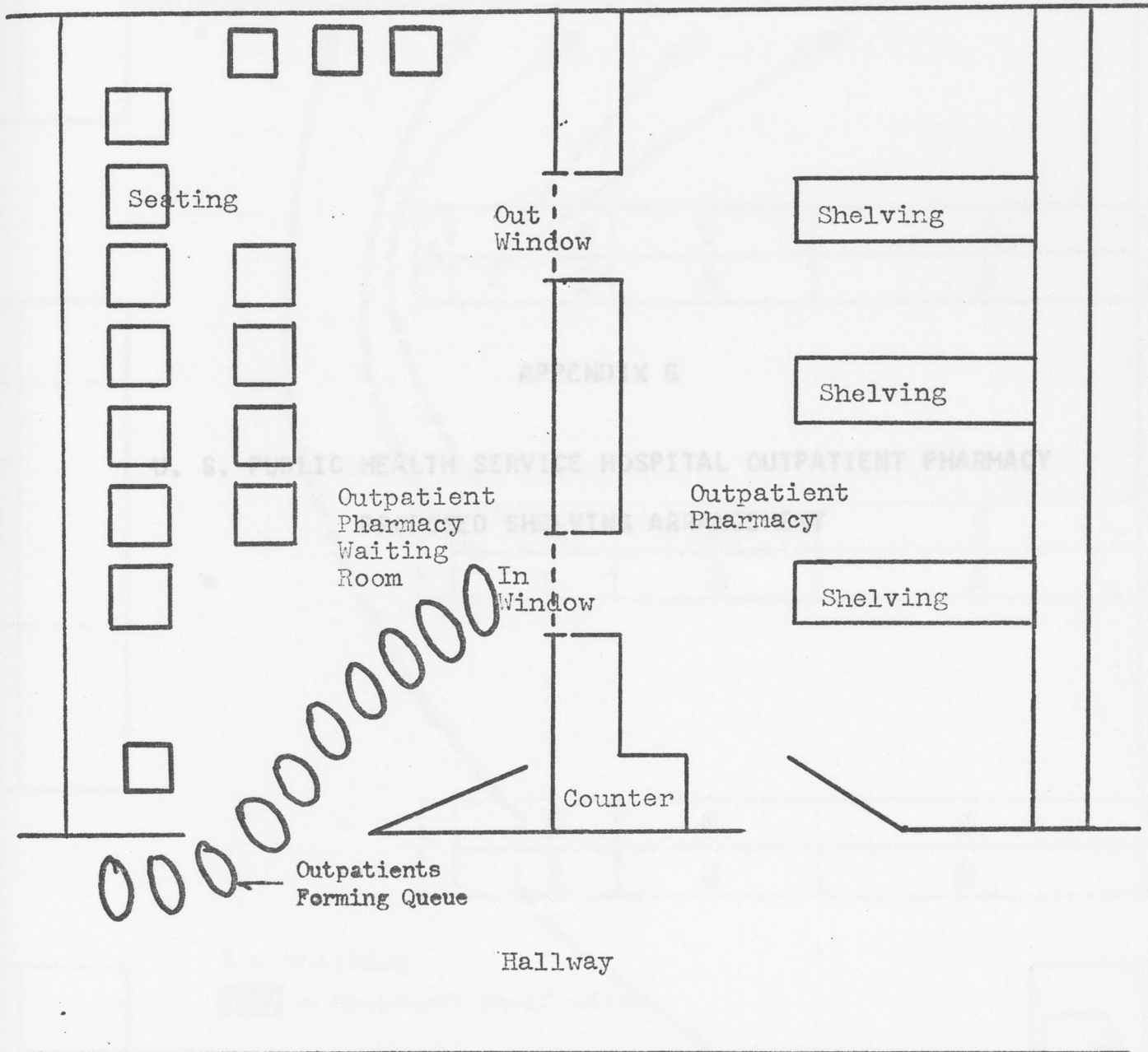
AUTHORIZATION IS GIVEN FOR DISPENSING BY NON-PROPRIETARY NAME UNLESS CHECKED HERE

KEEP OUT OF THE REACH OF CHILDREN

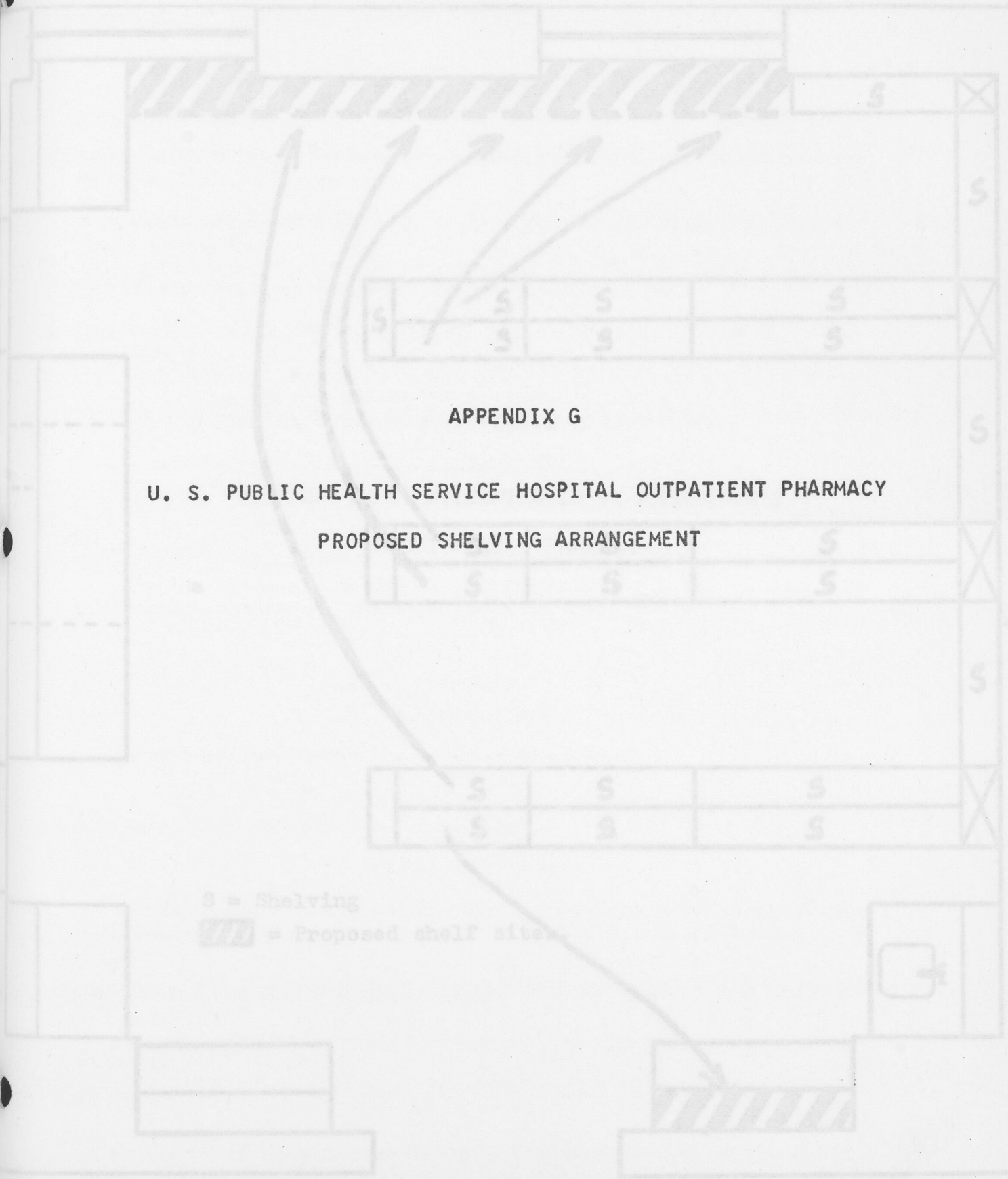
OUTPATIENT PHARMACY QUEUE



OUTPATIENT PHARMACY QUEUE



PROPOSED SHELVING ARRANGEMENT

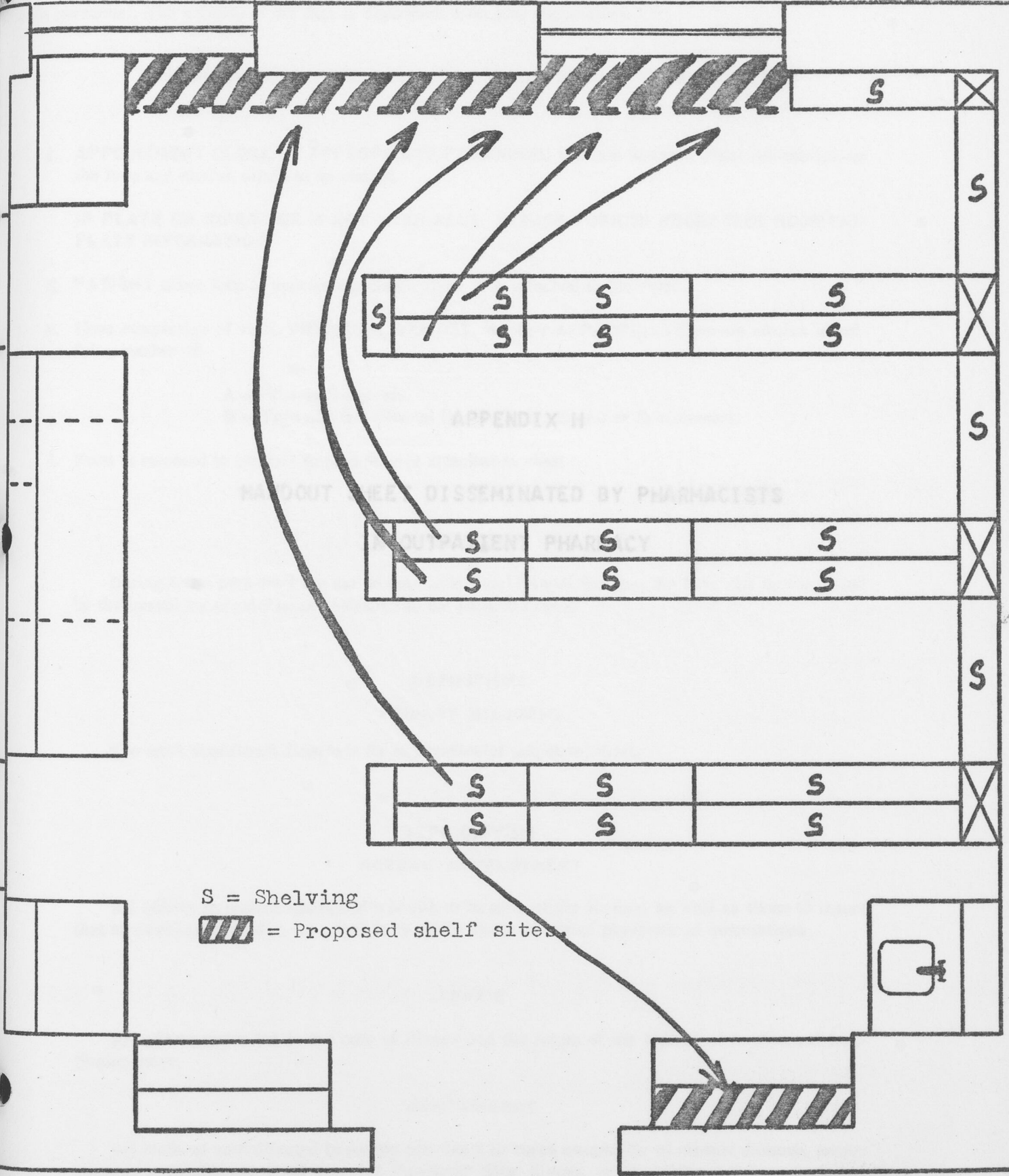


APPENDIX G

U. S. PUBLIC HEALTH SERVICE HOSPITAL OUTPATIENT PHARMACY  
PROPOSED SHELVING ARRANGEMENT

S = Shelving  
[Hatched Box] = Proposed shelf sites

PROPOSED SHELVING ARRANGEMENT



APPENDIX II

NOT TO BE DISSEMINATED BY PHARMACISTS

PHARMACY

The information provided by the completion of this form will be used in evaluating the desirability of utilizing computer technology to provide readily accessible data of use to clinicians, clinical researchers, and to management personnel. The validity of the data is dependent upon your cooperation.

**NORMAL WORKING HOURS 9:00 A.M. - 4:30 P.M., MONDAY THROUGH FRIDAY**

1. APPOINTMENT CLERK or APPROPRIATE PERSONNEL imprints hospital plate information on the form and circles clinic to be visited.

IF PLATE OR IMPRINTER IS NOT AVAILABLE, PLEASE FURNISH REQUESTED HOSPITAL PLATE INFORMATION.

2. PATIENT takes form to appropriate clinic where it is attached to the chart.

3. Upon completion of visit, PHYSICIAN, DENTIST, or other APPROPRIATE person circles identifying number of:

A - Primary Diagnosis.

B - Type of Visit (Normal Development or Containment)

**APPENDIX H**

4. Form is returned to Medical Record Service attached to chart.

**HANDOUT SHEET DISSEMINATED BY PHARMACISTS  
IN OUTPATIENT PHARMACY**

During hours personnel are not on duty in Medical Record Service, the form will be completed by the examining physician and attached to the patient's chart.

**DEFINITIONS**

**PRIMARY DIAGNOSIS**

The most significant diagnosis for any particular outpatient visit.

**TYPE OF VISIT**

**NORMAL DEVELOPMENT**

All efforts to protect individual's health or to prevent his illness, as well as those to insure that he develops normally, i.e., well baby clinic visits or annual physicals or inoculations.

**REPAIR**

All efforts expended in the care of illness and the return of the individual to a normal functioning state.

**CONTAINMENT**

All kinds of care directed to people who can't be cured completely of chronic disease, mental illness, or conditions of old age that "contain" their illness, or disability at the most minimal level, i.e., rehabilitation visits, routine checks on chronic diseases such as congestive heart failure.

OUTPATIENT RESEARCH MEDICAL RECORD FORM

74

The information provided by the completion of this form will be used in evaluating the desirability of utilizing computer technology to provide readily accessible data of use to clinicians, clinical researchers, and to management personnel. The validity of the data is dependent upon your cooperation.

**NORMAL WORKING HOURS 8:00 A.M. -4:30 P.M., MONDAY THROUGH FRIDAY**

1. **APPOINTMENT CLERK** or **APPROPRIATE PERSONNEL** imprints hospital plate information on the form and circles clinic to be visited.

**IF PLATE OR IMPRINTER IS NOT AVAILABLE, PLEASE FURNISH REQUESTED HOSPITAL PLATE INFORMATION.**

2. **PATIENT** takes form to appropriate clinic where it is attached to the chart.
3. Upon completion of visit, **PHYSICIAN, DENTIST,** or other **APPROPRIATE** person circles identifying number of:

A - Primary Diagnosis.

B - Type of Visit (Normal Development, Repair or Containment)

4. Form is returned to Medical Record Service attached to chart.

**OTHER HOURS**

During hours personnel are not on duty in Medical Record Service, the form will be completed by the examining physician and attached to the patient's chart.

**DEFINITIONS**

**PRIMARY DIAGNOSIS**

The most significant diagnosis for any particular outpatient visit.

**TYPE OF VISIT**

**NORMAL DEVELOPMENT**

All efforts to protect individual's health or to prevent his illness, as well as those to insure that he develops normally, i.e., well baby clinic visits or annual physicals or inoculations.

**REPAIR**

All efforts expended in the cure of illness and the return of the individual to a normal functioning state.

**CONTAINMENT**

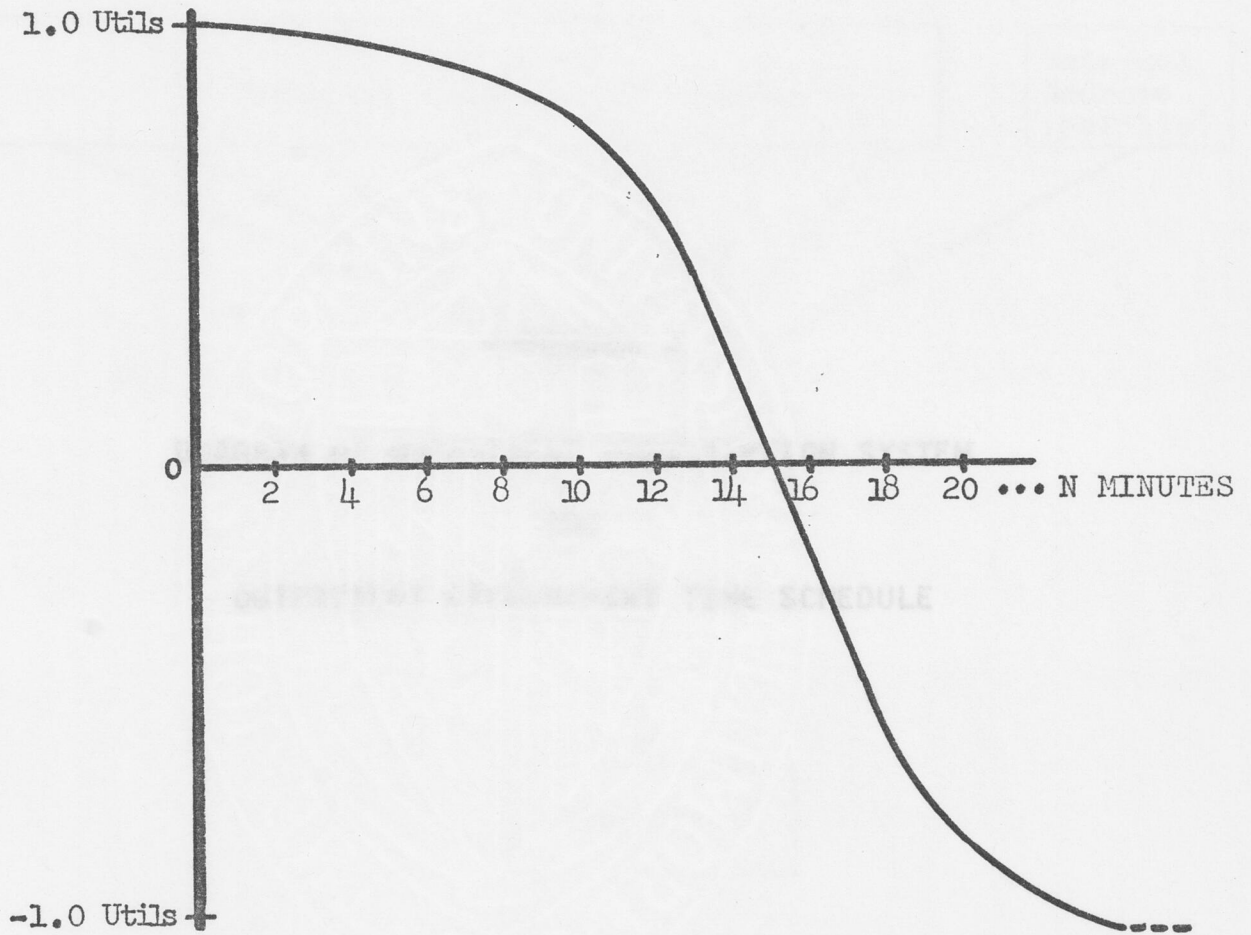
All kinds of care directed to people who can't be cured completely of chronic disease, mental illness, or conditions of old age that "contain" their illness, or disability at the most minimal level, i.e., rehabilitation visits, routine checks on chronic diseases such as congestive heart failure.



APPENDIX I

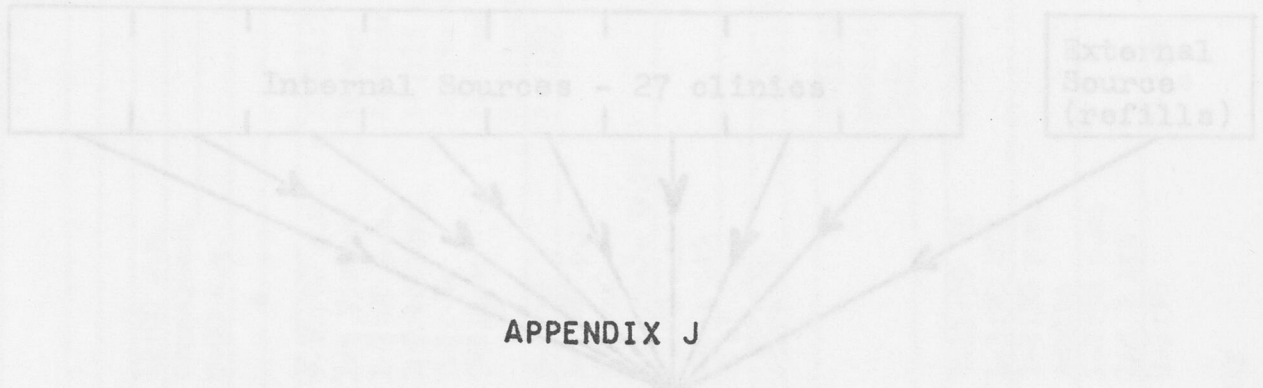
SATISFACTION MEASURED IN UTILS

A CHART OF RELATIVE SATISFACTION  
MEASURED IN UTILS



A CHART OF RELATIVE SATISFACTION  
MEASURED IN UTILS

OUTPATIENT PRESCRIPTION SYSTEM

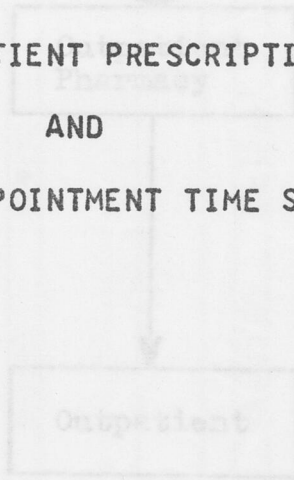


APPENDIX J

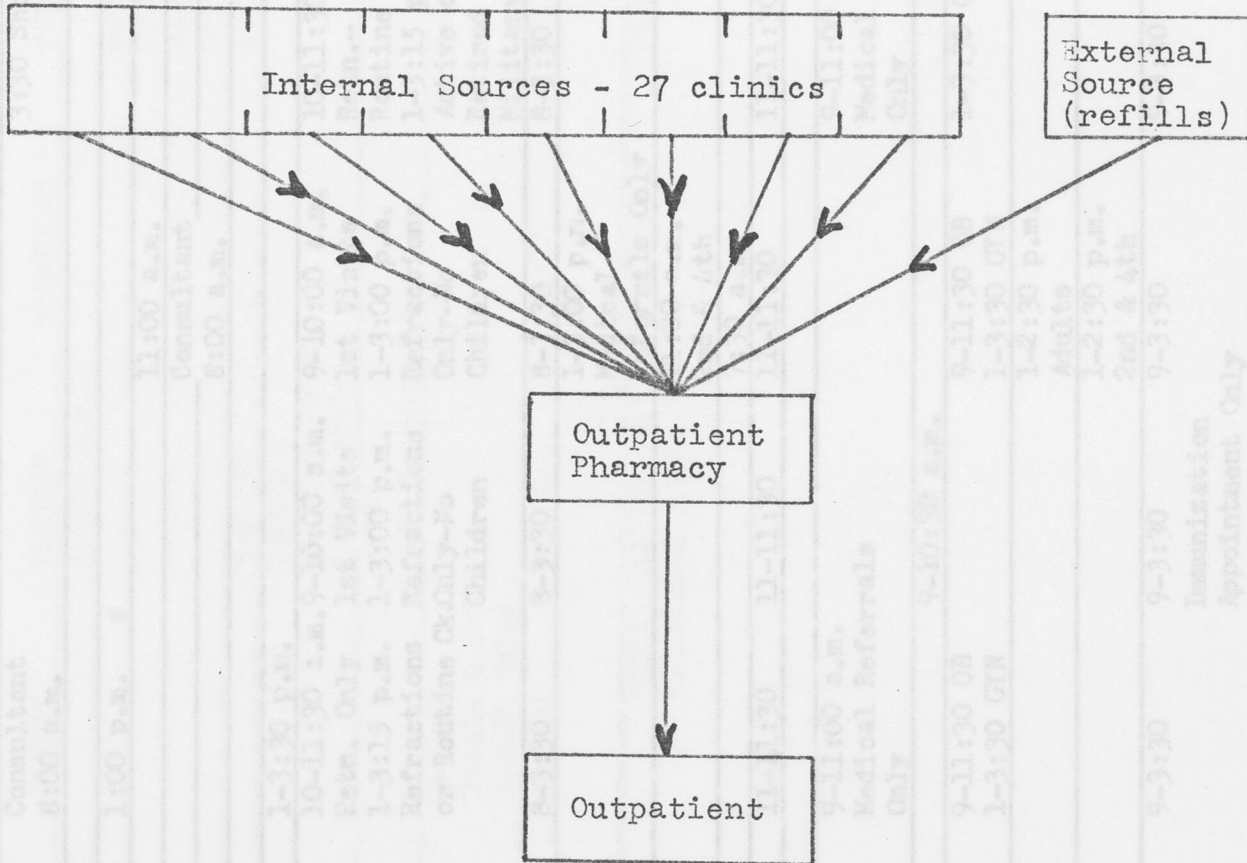
DIAGRAM OF OUTPATIENT PRESCRIPTION SYSTEM

AND

OUTPATIENT APPOINTMENT TIME SCHEDULE



OUTPATIENT PRESCRIPTION SYSTEM



APPOINTMENT TIME SCHEDULE OF OUTPATIENT CLINIC

USPHS Hospital, New Orleans, Louisiana

CLINIC	ROOM	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
ALLERGY	Spec Clinic	Consultant 8:00 a.m.				
CASE	Spec Clinic			11:00 a.m. Consultant		8:30 a.m.
CARDIOLOGY	Spec Clinic	1:00 p.m.				
CHEST	Spec Clinic			8:00 a.m.		
DERMATOLOGY	Spec Clinic					
ENDOCRINE	Spec Clinic					
ENT	Second Floor South	1-3:30 p.m.				
EYE	Second Floor South	10-11:30 a.m., 9-10:00 a.m. Retn. Only 1-3:15 p.m. Refractions Refractions or Soutine Ok. Only- Children	9-10:00 a.m. 1st Vis 1-3:00 p.m. Refractions Refractions or Soutine Ok. Only- Children	9-10:00 a.m., 10-11:15 a.m., Retn. Refractions 1-3:15 p.m., Retn. Refractions		
GENERAL	First Floor					
GASTRO- INTESTINAL	Spec Clinic					
HAIR	Spec Clinic					
HYPERTENSION	Spec Clinic					
MEDICINE	Spec Clinic					
NEUROLOGY	Second Floor East					
NEURO-SUBJECT	Spec Clinic					
OB-GYN	Third Floor West					
ORTHOPEDICS	Spec Clinic					
ORTHOPEDIC-PED	Spec Clinic					
PEDIATRICS	First Floor West					

CLINIC	ROOM	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
ALLERGY	Spec Clinic	Consultant 8:00 a.m.			3:30 Shots	
CAST	Spec Clinic					8:30 a.m.
CARDIOLOGY	Spec Clinic	1:00 p.m.				
CHEST	Spec Clinic			11:00 a.m.		
DERMATOLOGY	Spec Clinic			Consultant 8:00 a.m.		9:00 a.m.
ENDOCRINE	Spec Clinic					9:00 a.m.
ENT	Second Floor South	1-3:30 p.m.				1-3:30 p.m.
EYE	Second Floor South	10-11:30 a.m. Retn. Only	9-10:00 a.m. 1st Visits	9-10:00 a.m. 1st Visits	10-11:30 a.m. Retn.-	10-11:30 a.m. Retn. or
	Spec Clinic	1-3:15 p.m. Refractions	1-3:00 p.m. Refractions	1-3:00 p.m. Refractions	Routine Ck. 1-3:15 p.m.	Refraction 1-3:15 p.m.
	Spec Clinic	or Routine Ck. Only-No	Children	Only-No Children	Active or Retired Military	Retn. or Refraction
GENERAL	First Floor	8-3:30	8-3:30	8-3:30	8-3:30	8-3:30
GASTRO- INTESTINAL	Spec Clinic			1-3:00 p.m. Medical Referrals Only		
HANSEN	Spec Clinic			11:00 a.m. 2nd & 4th 7:30 a.m.		
HYPERTENSION	Spec Clinic					
MEDICINE	Spec Clinic	11-11:30	11-11:30	11-11:30	11-11:30	11-11:30
NF	Second Floor East					
NEUROLOGY	Spec Clinic	9-11:00 a.m. Medical Referrals Only			9-11:00 a.m. Medical Referrals Only	
NEURO-SURGERY	Spec Clinic		9-10:30 a.m.			
OB-GYN	Third Floor West	9-11:30 OB 1-3:30 GYN		9-11:30 OB 1-3:30 GYN	1-3:30 GYN	9-11:30 OB
ORTHOPEDICS	Spec Clinic			1-2:30 p.m. Adults		1-2:30 p.m. Adults
ORTHOPEDIC-PED	Spec Clinic			1-2:30 p.m. 2nd & 4th		
PEDIATRICS	First Floor West	9-3:30	9-3:30	9-3:30	9-3:30	9-3:30

Immunization  
Appointment Only

APPOINTMENT SCHEDULE (continued)

USPHS Hospital, New Orleans, Louisiana

CLINIC	ROOM	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
PLASTIC	Spec Clinic		1-2:00 p.m.			
PYELOSTUDY	Spec Clinic				9:00 a.m.	
RENAL	Spec Clinic				9:00 a.m. Medical Referrals Only	
SURGERY	Spec Clinic		9-10:30 Female & Children Retns. 1-2:10 Adults		1-2:10 Adults	
SURGERY-Miner Rectal-Sigmoid	Spec Clinic		8:30 8:30 Surgery Referrals			
UROLOGY	Spec Clinic	9-10:30 Female & Child 1-2:30 Males			1-2:30 Males	
DENTAL	Second Floor South	8-4:30	8-4:30	8-4:30	8-4:30	8-4:30

APPOINTMENT DESK: Ext. 341 & 342

DENTAL CLINIC: Ext. 273 & 274  
PSYCHIATRIC: Ext. 350

OB-GYN: Ext. 328 & 329

Medical Record Department  
July, 1969

VOLUNTARY SURVEY

Are you employed?

Yes ---

No ---

Is your waiting time costing you money?

Yes ---

No ---

If so, about how much per \_\_\_\_\_

APPENDIX K

SURVEY OF OUTPATIENT WAITING

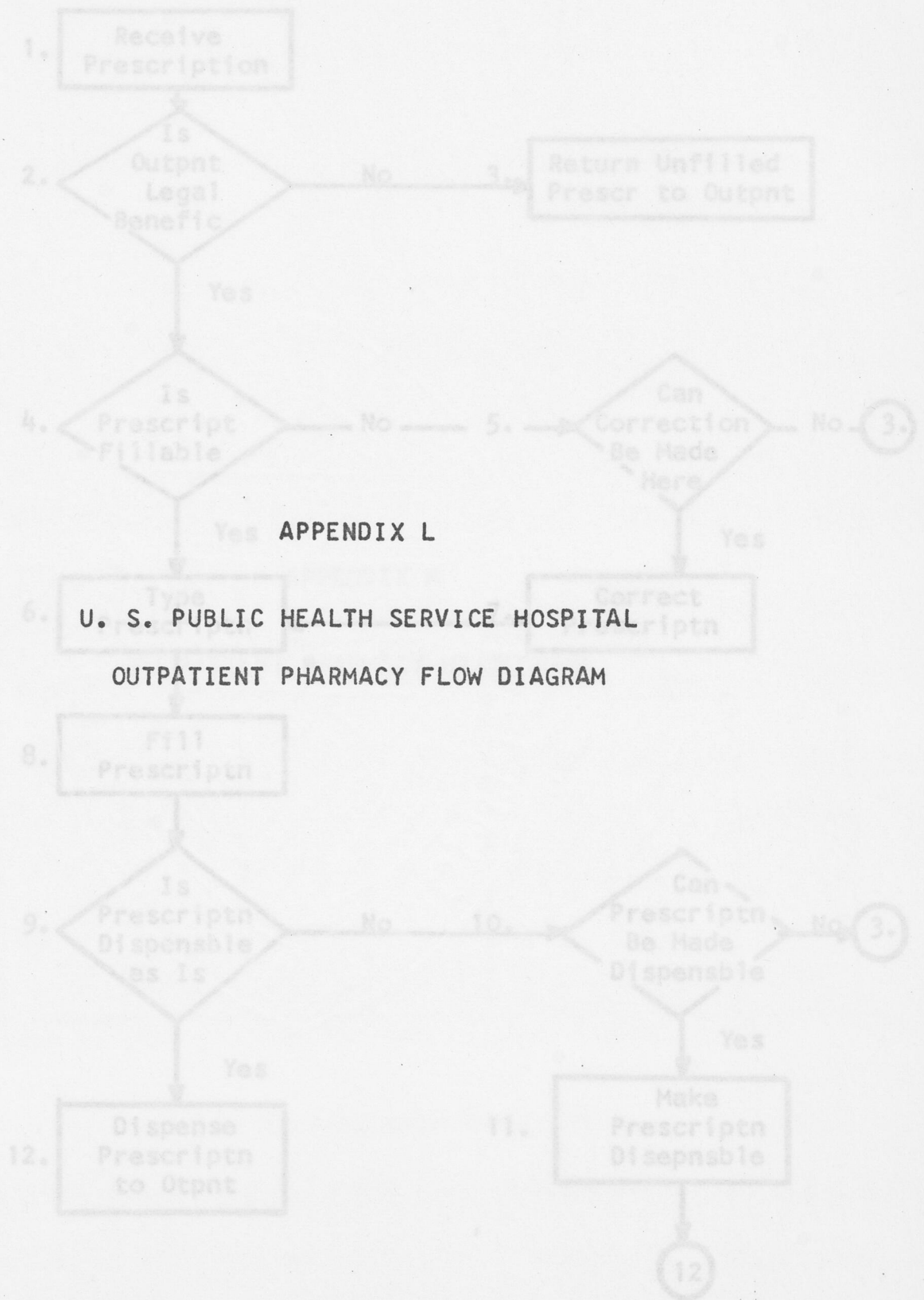
TIME COSTS

## VOLUNTARY SURVEY

Are you employed?

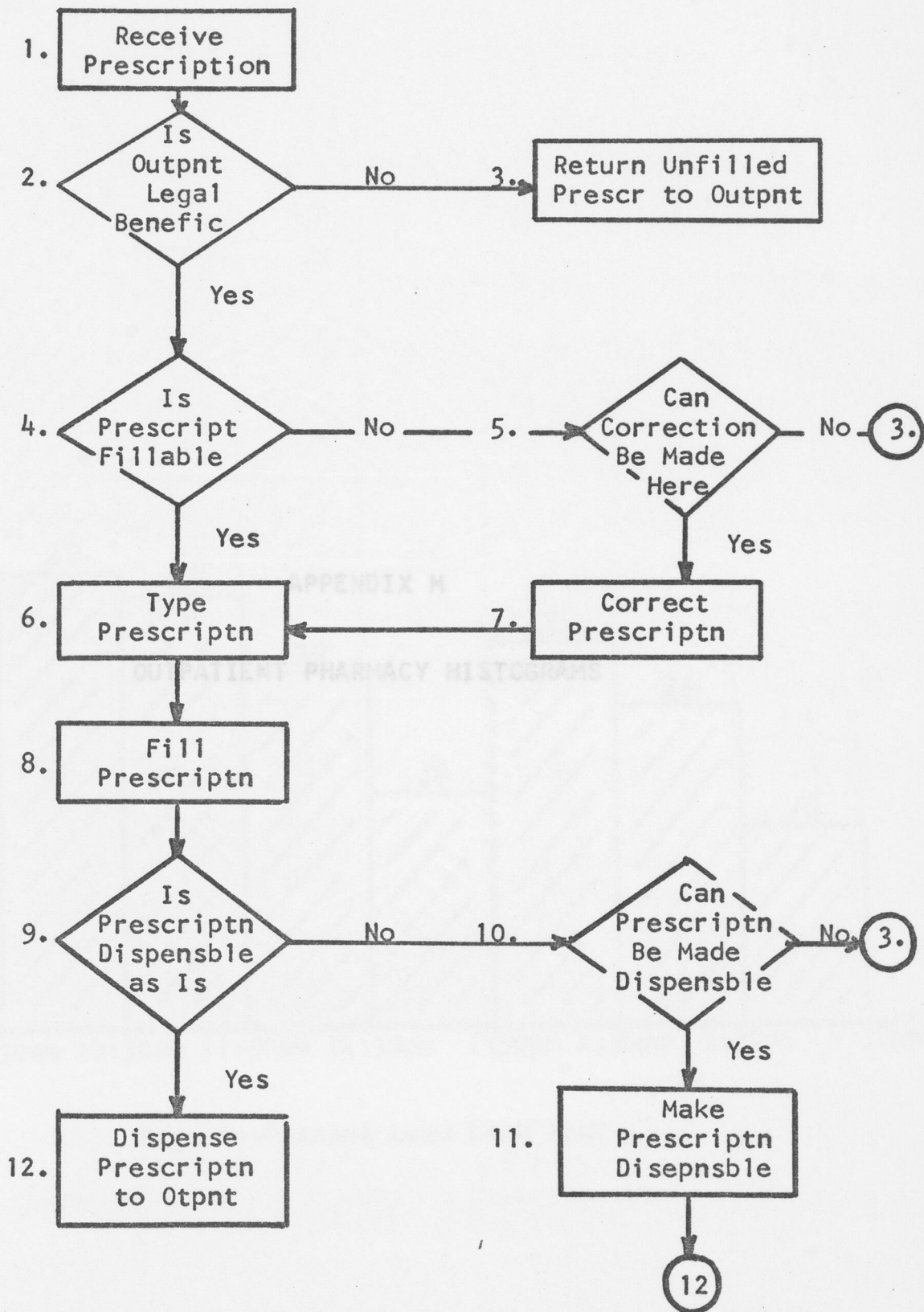
Yes --- No --- Is your waiting time  
costing you money?Yes --- No --- If so, about how much  
per hour?

\_\_\_\_\_

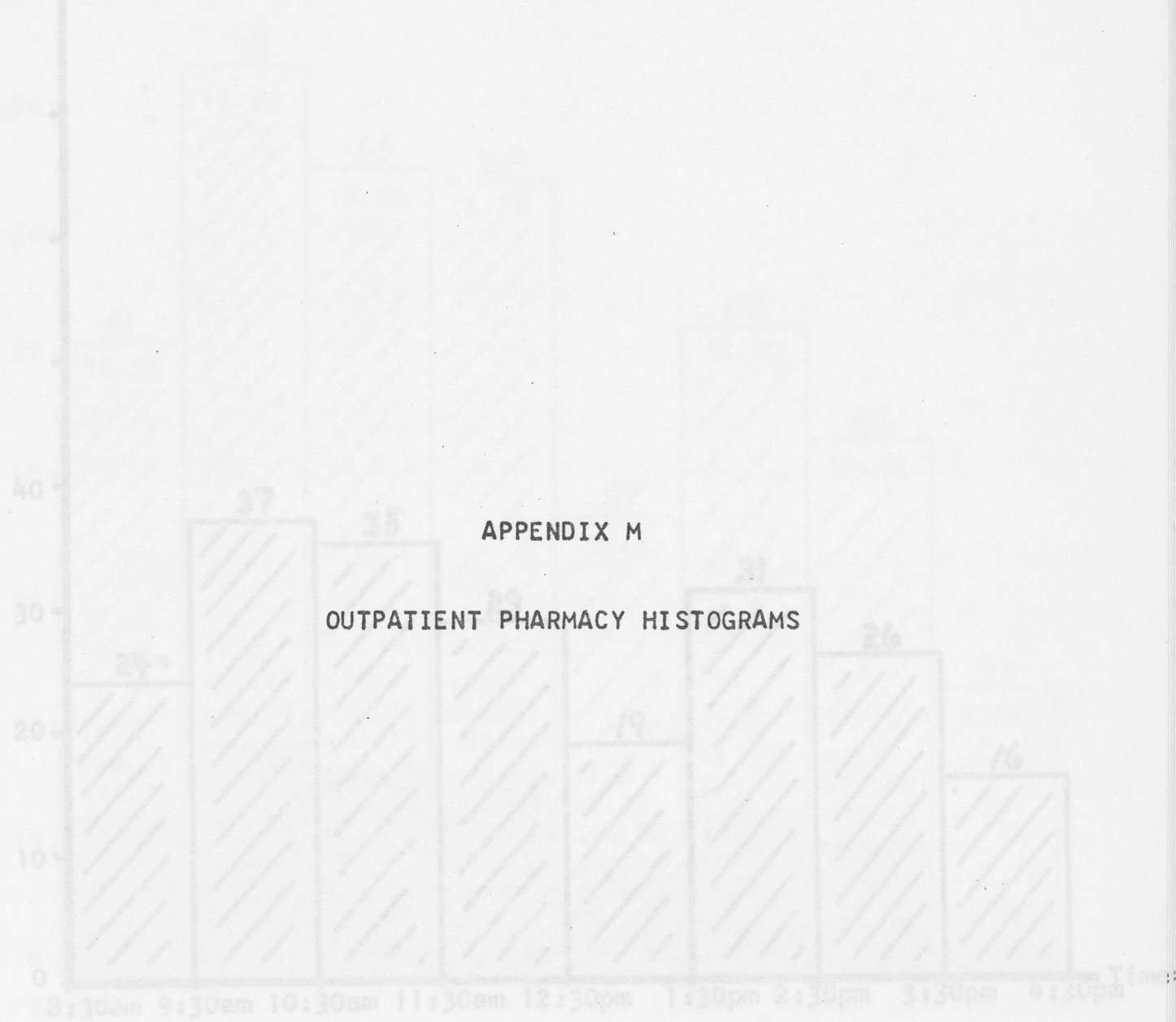


APPENDIX L

U. S. PUBLIC HEALTH SERVICE HOSPITAL  
OUTPATIENT PHARMACY FLOW DIAGRAM



Number Patients



APPENDIX M

OUTPATIENT PHARMACY HISTOGRAMS

Fig. 1--Patient Load Each Hour  
April 13-17, 1977. Histogram of patient load at each hour of total day. This information was for 15-minute periods of day each hour.

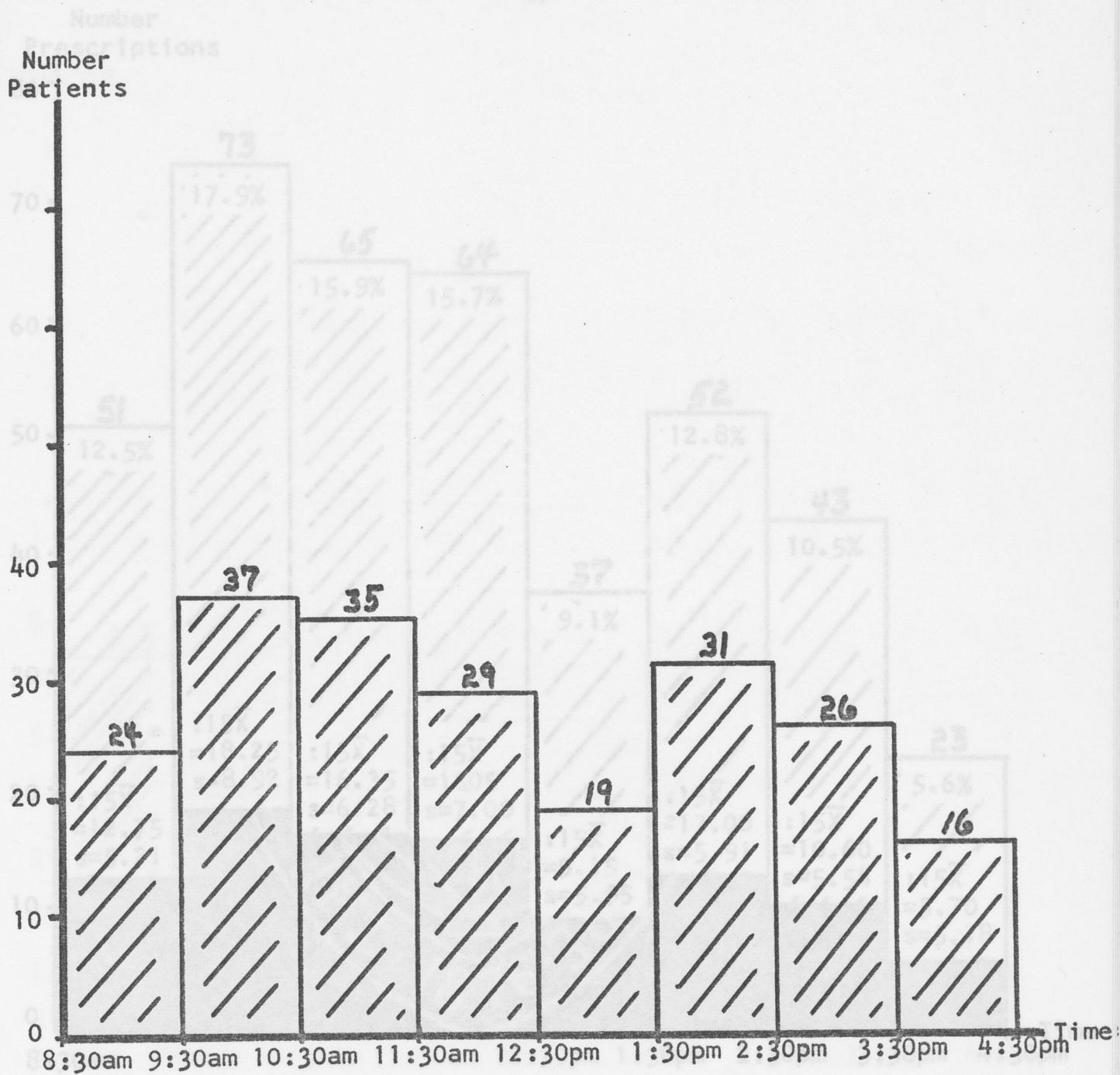


Fig. 1--Patient Load Each Hour (April 13-17, 1970), expressed as per cent of total, and Mean Prescription Rate for 15-minute Periods during Each Hour

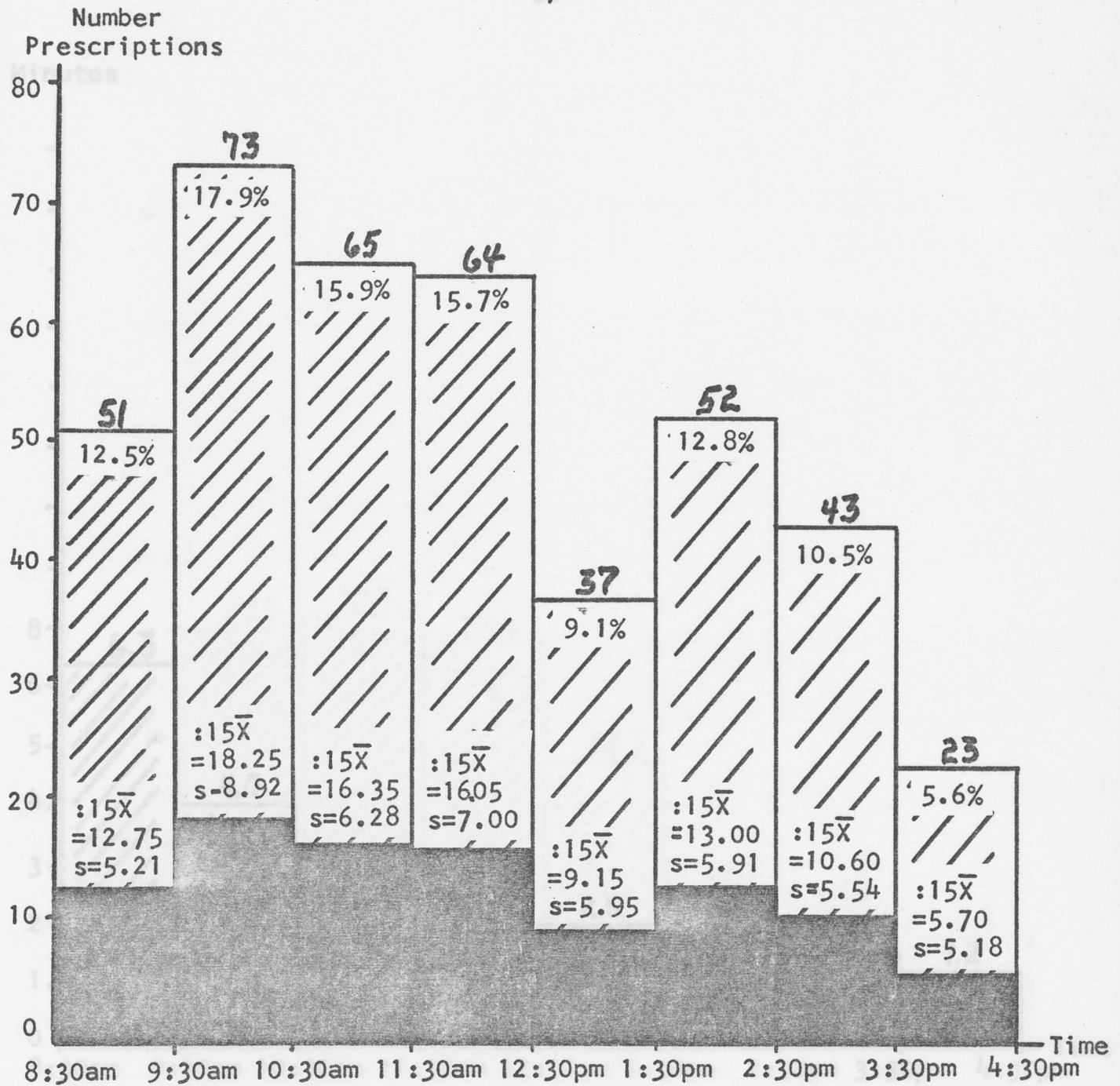


Fig. 2--Mean Prescription Load Each Hour (April 13-17, 1970), expressed as per cent of total, and Mean Prescription Rate for 15-minute Periods during Each Hour

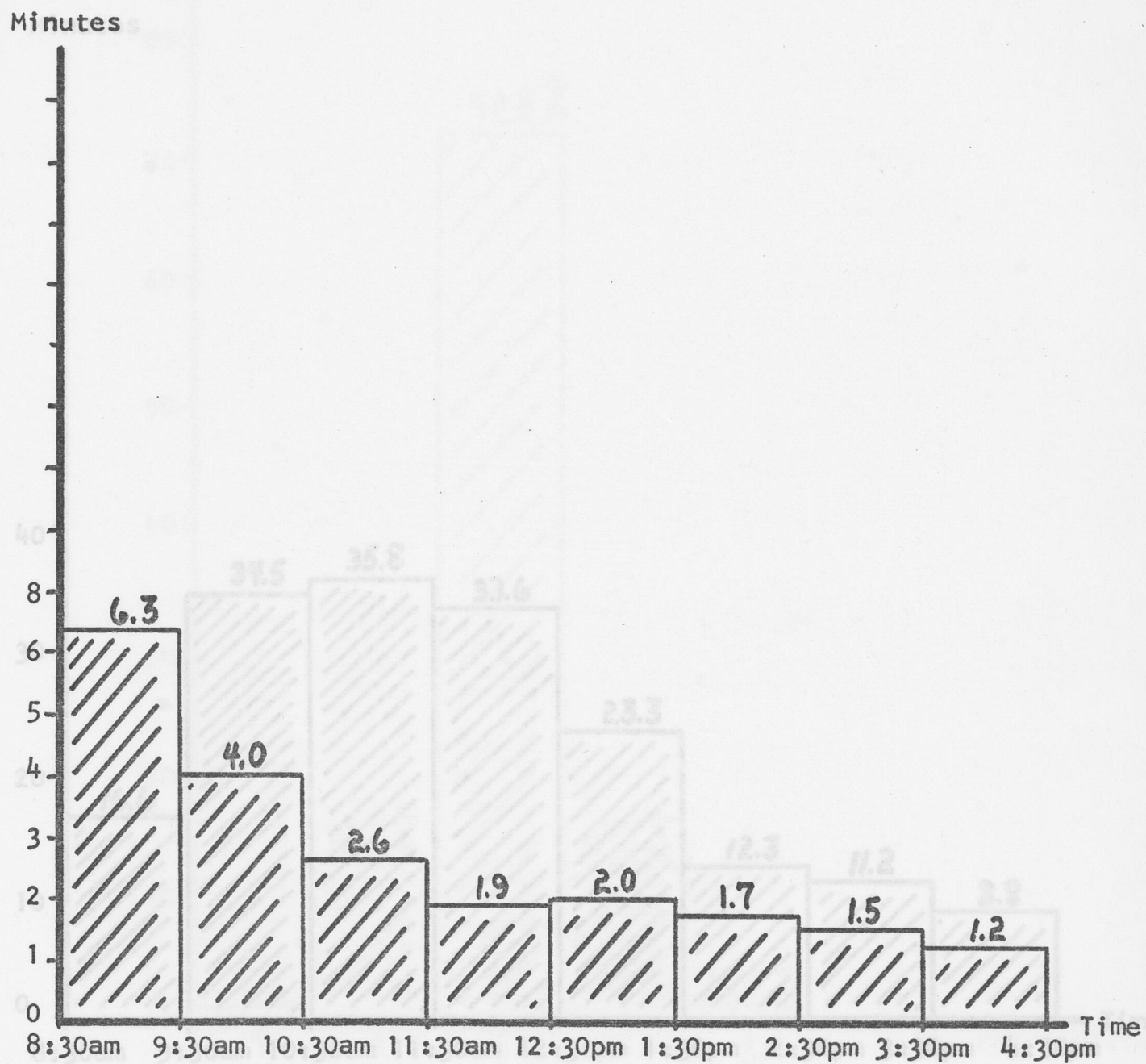


Fig. 3--Mean Waiting Time at the Inwindow

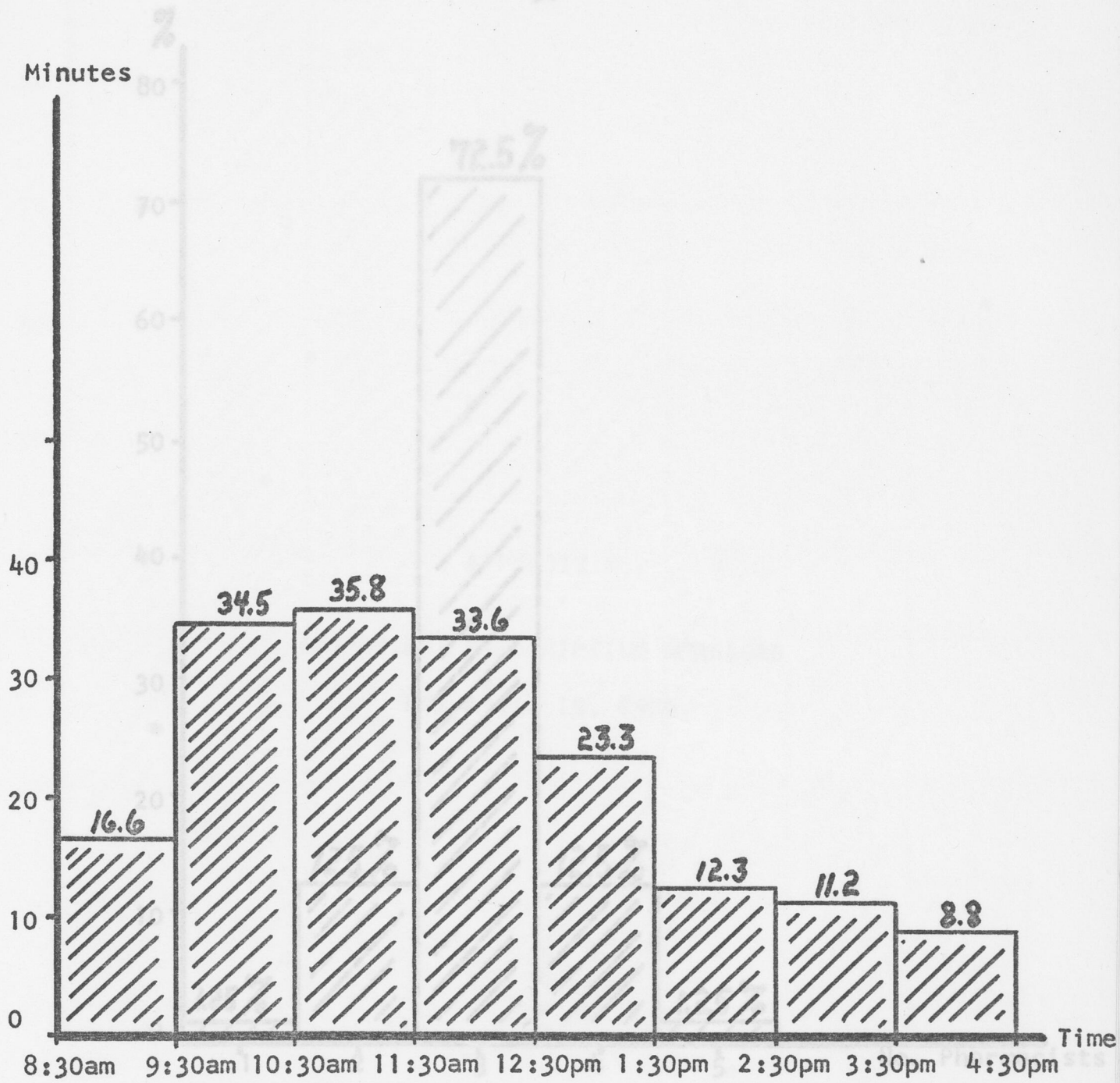


Fig. 4--Mean Waiting Time at the Outwindow

Fig. 5--Outpatient Pharmacy Staffing  
Expressed as a Percentage of  
Total Time

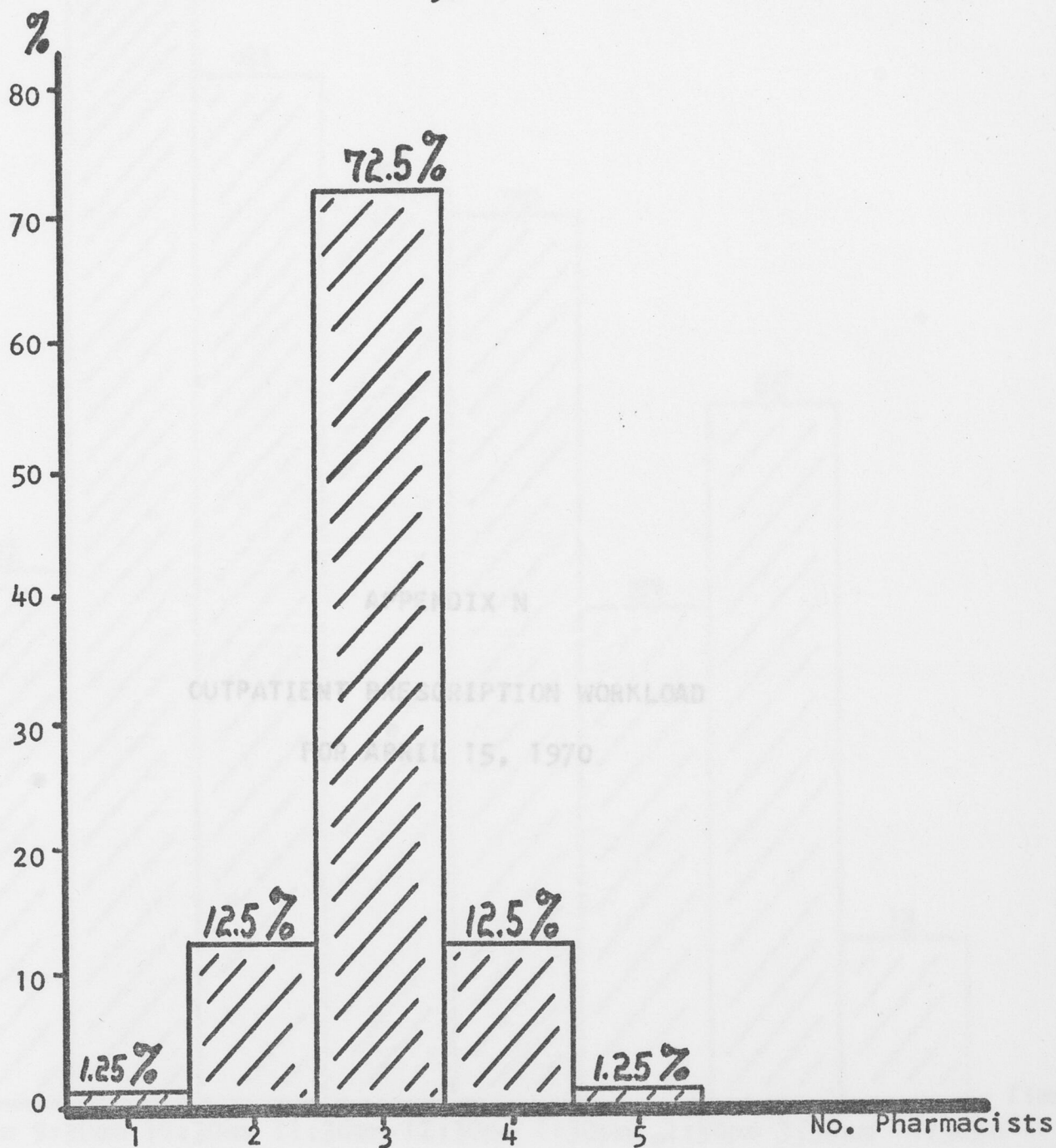
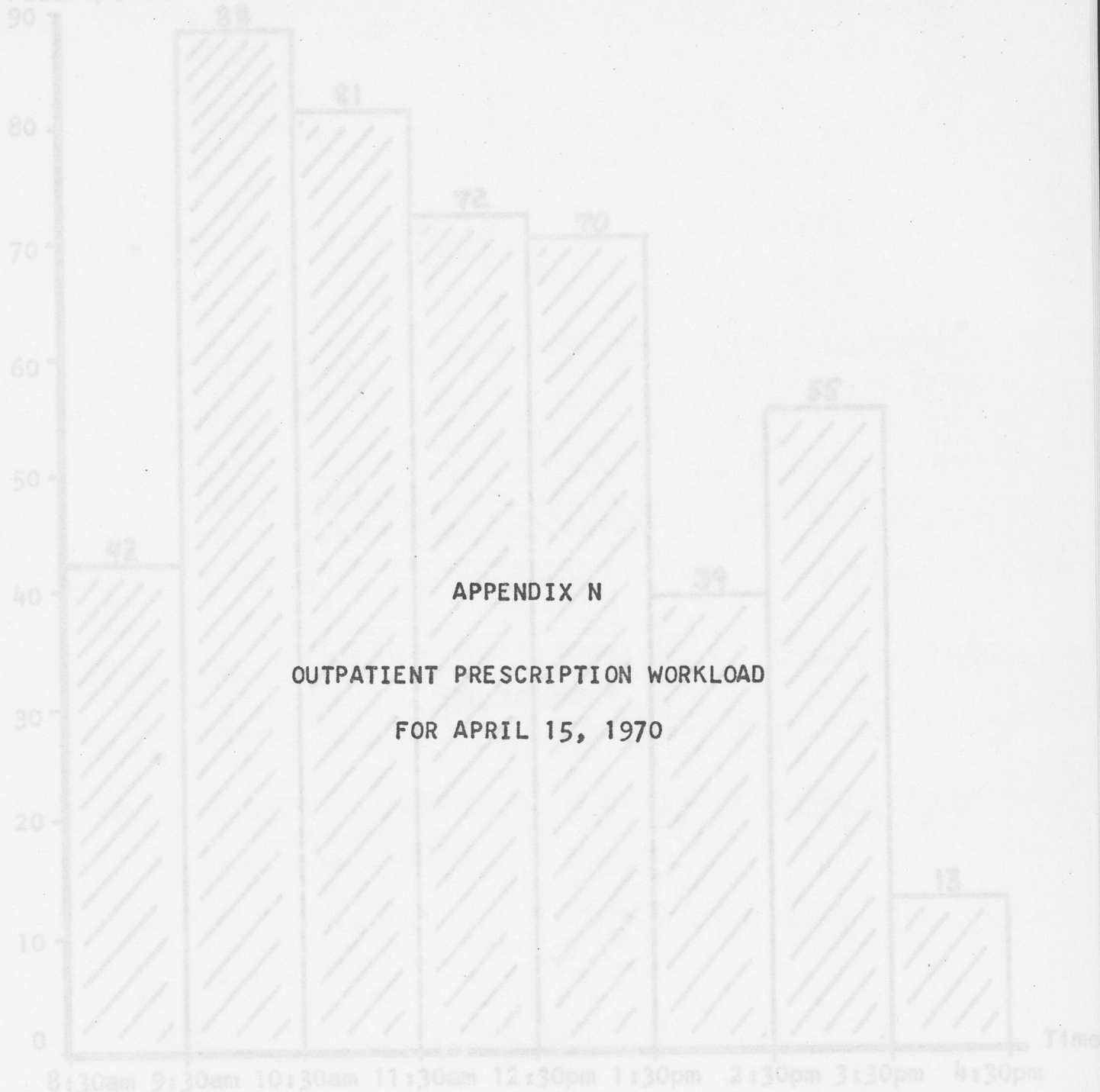


Fig. 5--Outpatient Pharmacy Staffing  
Expressed as a Percentage of  
Total Time

Number  
Prescriptions

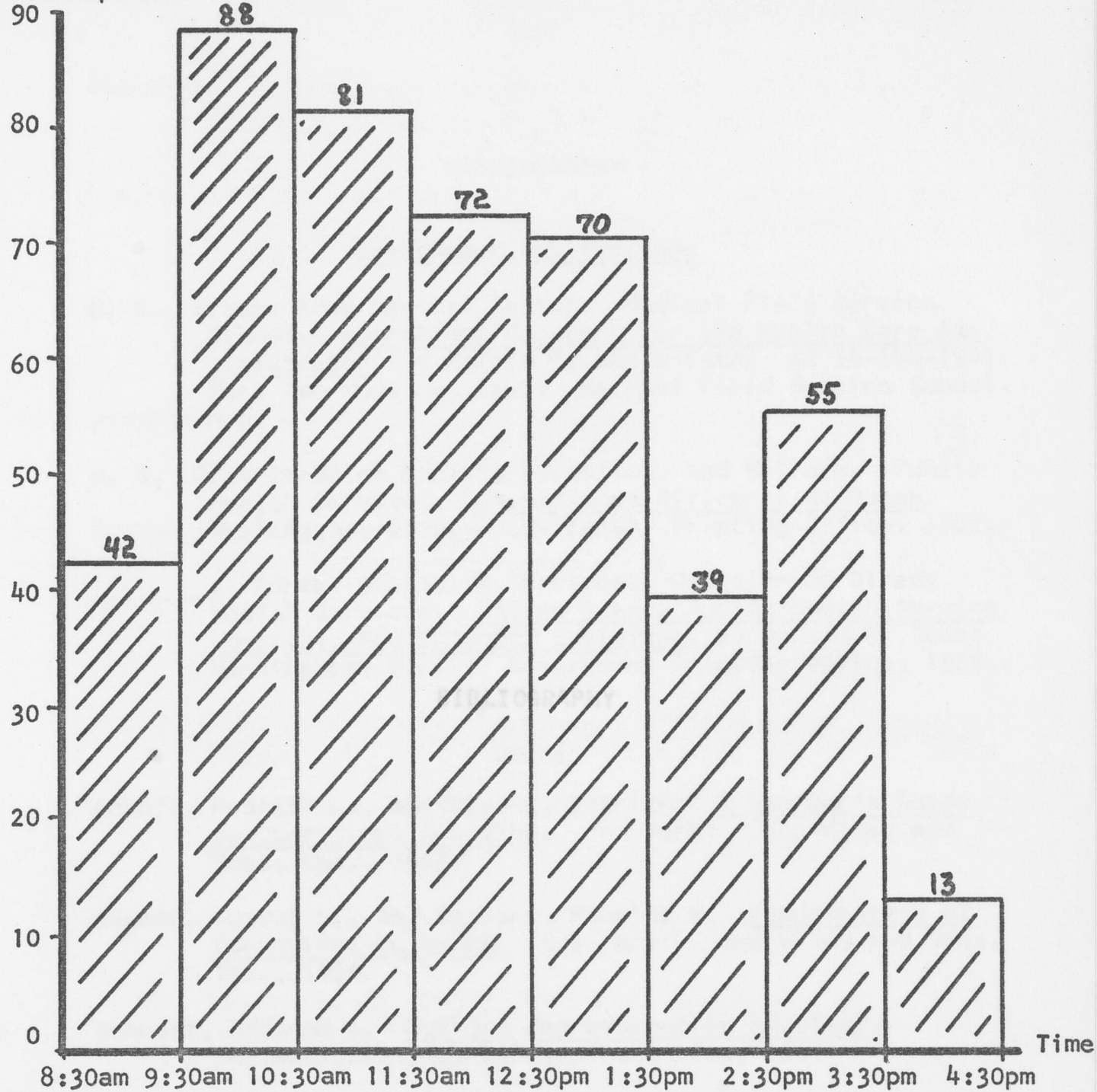


APPENDIX N  
OUTPATIENT PRESCRIPTION WORKLOAD  
FOR APRIL 15, 1970

OUTPATIENT PRESCRIPTION WORKLOAD FOR  
APRIL 15, 1970

Number  
Prescriptions

92



OUTPATIENT PRESCRIPTION WORKLOAD FOR

APRIL 15, 1970

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## ABSTRACT

### A STUDY OF THE OUTPATIENT PHARMACY QUEUE AT THE U. S. PUBLIC HEALTH SERVICE HOSPITAL, NEW ORLEANS, LOUISIANA

A Problem Solving Thesis Submitted to the Faculty of Baylor  
University in Partial Fulfillment of the Requirements  
for the Degree of  
Master of Hospital Administration

by  
Major James A. Eberwine, MSC

August, 1971

98 Pages

A copy of this document may be obtained on interlibrary loan from Stimson Library, United States Army Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Texas.

This problem-solving thesis was accomplished to determine what steps the U. S. Public Health Service Hospital, New Orleans, Louisiana, should take to significantly shorten the length of the queue in the outpatient pharmacy. Current literature related to outpatient pharmacies and queueing theory was reviewed, interviews were conducted, and a systems analysis was performed. Data were accumulated and comparisons made on the frequency of outpatients, the frequency of prescriptions, the relative pharmacy staffing, and the queue lengths. Several areas requiring additional managerial effort were determined to reduce the queues, maximize the use of assigned pharmacists, improve the layout of the pharmacy, and establish a patient-oriented environment for the outpatients during their waiting period. Conclusions included: (1) selected shelving should be relocated, (2) the typist position should be filled with a typist rather than a pharmacist, (3) three pharmacists should be utilized in addition to the typist when the queue length exceeds 15 minutes, (4) four pharmacists should be utilized in addition to the typist when the queue length exceeds 20 minutes, (5) the intercom system should be operable to summon patients, (6) pictures, curtains, color schemes, and magazines should enhance the waiting room, and (7) the inwindow and the outwindow should be reversed to relocate the inwindow queue. It was recommended that each step in the conclusion be approved and implemented in the priority listed.