THE APPLICATION OF THE PRINCIPLES OF INDUSTRIAL ENGINEERING TO A HOSPITAL SITUATION

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THE APPLICATION OF THE PRINCIPLES OF INDUSTRIAL ENGINEERING TO A HOSPITAL SITUATION

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CHAPTER I

INTRODUCTION

A. The Necessity for This Type of Work

In 1950 the entire country was in a period of increased spending. The cost of living as indicated by the various indices throughout the country was at an all time high and the peak of the spiral was not yet in sight. The cost of operating a hospital was no different from the cost of any other services throughout the country. In 1946 for instance the cost per patient day at Harper Hospital was $16.06. This had jumped until at the end of 1950 the cost per patient day was $25.87. This was a considerable increase and one about which the public was expressing greater and greater indignation. Some people tried to minimize this increased cost by saying that it was not out of line with the increase in other phases of our economy. This in no way lessened the gravity of the problem.

There was also another problem confronting the hospital field and one which perhaps was even more serious than the problem of increased costs. It was not possible to obtain sufficient professional help to answer the needs of the existing hospitals even

though sufficient money was available to pay the demands of these people. In the Detroit area there was a need for 613 more registered nurses to adequately handle the existing facilities. There were plans in the making or plans which had been completed by which it was intended to increase the hospital facilities of the Detroit Metropolitan Area. Some of these plans were being held up merely because there was not sufficient professional help available with which to staff the added facilities if the proposed construction were completed.

The shortage had been lessened to some extent by turning over some work to practical nurses. There were 781 people in this classification working in the Detroit area but also there was a shortage of practical nurses with 284 more being needed to staff the present facilities.

This was the situation that faced the Board of Directors of the Harper Hospital, a 590 bed institution, in the heart of Metropolitan Detroit in the summer of 1950. They did not feel, as trustees of the Harper Hospital, that they should sit back and explain that the increased patient cost and the shortage of professional help was a matter of circumstances due to our present economy and that nothing could be done about it.

B. The Approach to the Problem

With all of these factors in mind it was decided that the situation was of a serious enough nature to require the full-time study of some one skilled in the management field. Accordingly, a project entitled "The Improvement of Patient Care" was organized at Harper Hospital. A full time director was employed to make a study of what could be done to remedy the situation. Miss Marion Wright, since promoted to Associate Director of Harper Hospital, was employed to head the study. She eminently qualified for the job, having had experience as a registered nurse, as a supervisor of nurses, and later having taken graduate work in hospital administration. A preliminary survey was made and an over-all plan was proposed. This over-all plan was intended to be used as a guide to outline some areas in which a detailed study should be started.

C. The Over-all Aim

A statement of the over-all aim of The Improvement of Patient Care Committee was, "to plan ways and means for providing adequate but safe patient care in a manner most economical to the hospital and to the

patient."[1] In order to further define the purpose of the committee the following proposals were set forth:

1. To study current practices in the field to gain helpful suggestions and ideas.

2. To find out the attitude of the patient and the medical staff in order to obtain from them suggestions that might assist in improving patient care.

3. To analyze skill requirements in various activities in order to make maximum utilization of professional personnel by determining what activities the non-professional may safely perform for the patient, both mental and physical.

4. To study and now existing functions of departments and assignment of duties of personnel, realign and reorganize these to provide a more efficient service to patients.

5. To determine the amounts and kinds of personnel necessary to give this care by an analysis of the patient and the activities related to his care.

6. To determine the preparation and training necessary for various classifications of personnel and recommend plans to accomplish this.

7. To investigate labor saving devices and prove that their installation will reduce the work load of personnel.[2]

D. The Purpose of This Report

A study of the seven subheadings in the statement of the over-all aim of the Improvement of Patient Care Committee showed that items 3, 4, 5, and 7 in

particular lent themselves to the type of work for which the Industrial Engineer is trained. In the past, industrial management had been confronted with problems very similar to those faced by the hospitals. They had turned to the Industrial Engineer to work out solutions to these problems and to obtain more efficient operations. It was suggested that perhaps the Industrial Engineer could contribute to the project which was under way at Harper Hospital.

It is the purpose of this report to show how the principles of industrial engineering as applied by a committee of Industrial Engineers from the Detroit area, working under the auspices of the Society for the Advancement of Management did contribute to the solution of the problem; the improvement of patient care.

CHAPTER II

THE SCOPE OF THE INDUSTRIAL ENGINEERING APPLICATION AT HARPER HOSPITAL

A. The Industrial Engineering Approach to the Problem

In the original discussions of the Industrial Engineering group which was formed to consider the problem at Harper Hospital, it was decided that the problem should be attacked the same as any problem in industry. A hospital was an industry just as much as if it had been a manufacturing concern. Raw material was received into the factory. It was worked on, stored, handled, and after passing inspection it was shipped from the factory.[a]

After making this decision it was decided that the first step would be to become familiar with some of the over-all problems which were faced by the hospital. A trip was arranged for the Industrial Engineering group through Harper Hospital. On January 15, 1951 a considerable amount of time was spent in making a

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[a] The basic raw material is of course the sick patient and the finished product is the well patient.

complete and thorough tour through all of the typical units in the hospital and through all of the service units. The result of this tour was to confirm the original assumption of the Industrial Engineers, that the hospital was, in effect, a fairly large factory.

B. Definition of the Scope of the Industrial Engineering Program

After the Industrial Engineers had finished the tour of Harper Hospital a meeting was held in order to outline a specific approach that would be used in working out solutions to the problem, the improvement of patient care. After a considerable amount of discussion, it was decided that the efforts of the Industrial Engineers concerned could be best utilized if they were applied toward seven specific fields. These fields were as follows:

1. To develop better methods for the performance of needed tasks.

    a. To serve as concrete examples of what could be accomplished by the application of industrial engineering principles to the hospital situation.

    b. To effect immediate cost reduction in some areas where the Industrial Engineers believed that a maximum saving could be accomplished immediately.

2. To study control procedures from the point of view of simplifying the paper work necessary to run the hospital.

3. To study or analyze the job content of the various jobs in the hospital.

4. To develop standard times for hospital jobs.

5. To conduct a work simplification training program for hospital personnel.

6. To conduct a supervisory training program for hospital personnel with the emphasis to be placed on floor supervision.

7. To study the need for a training program for all personnel excluding nurses.[3]

A detailed study of the above objectives indicated that the industrial engineering committee had established a monumental job for themselves. It was decided that it would not be possible to attack all of these objectives at one time. A study of the objectives as listed seem to indicate that there was a definite sequence in which they should be attacked.

First, there was the problem of convincing the entire hospital industry that a bunch of "dirty" industrial engineers could come into a hospital and tell them or show them how they could better run their business.[b] The hospital field was, like many other

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[b] There was much outspoken, and at times bitter, expression of the opinion that engineers who were used to working with cold machines couldn't possibly understand the cleanliness and compassion necessary when dealing with human beings.

specialized fields, beset with traditional ways of performing certain tasks. Even though the Industrial Engineering Committee was operating at the request of the Directors of Harper Hospital, all people concerned were still somewhat skeptical as to the value which could be expected from such a project. It was, therefore decided that the number one task for the Industrial Engineering Committee was to immediately develop some better methods and thereby convince the skeptics that it was possible to apply the principles of industrial engineering to a hospital situation.

As a result of this decision, certain members of the Industrial Engineering Committee were assigned to begin work on some specific problems in order to develop a better method for doing these jobs.

C. The Necessity for a Continuing Program

There was one practice which had continually given the Industrial Engineering profession a bad reputation. This was the practice of some consulting engineers of going into a place of business on the grounds of establishing more efficient operation; and while solving a number of specific situations, failing to provide some vehicle which would insure that the more efficient operations would be continued

after the expert consultant had gone on to another job.

It was the earnest conviction, of all concerned with this program, that the only way that Harper Hospital could be really helped by a group of Industrial Engineers would be for the Industrial Engineers to guide members of Harper Hospital in such a way that they would be able to develop more efficient methods themselves. There would be little gained by having the engineers act as a group of experts to develop better methods, if after they had completed the project, these better methods were left to be performed by people who did not understand their intent or value. In most cases the uninformed persons would not have been in favor of the proposed change regardless of its value and therefore would revert back to the original methods at the first opportunity.

This problem was by no means peculiar to the hospital field. Exactly the same situation was constantly encountered in industry. Industrialists had long recognized that a good method was only good if it was understood and accepted by the people who were to use it. When confronted with this problem it was the custom of industry to establish a training program to give to the people involved the information which

they should have had about the industrial engineering program. It had been found that to fully explain industrial engineering was to take away most of the fear that the Industrial Engineer would cause harm to individuals or to the company as a whole.

It was decided that a training program should be established at Harper Hospital in order that all concerned could be given the basic information about the industrial engineering program. This training program would be known as Work Simplification Training Program.

It was decided also to institute at this time the supervisory training program. It was noted in the original survey that there was a decided lack of uniformity in the methods by which the various supervisors went about their jobs. It was thought, if a maximum benefit was to be derived from the results of the Improvement of Patient Care project, that the part of a well trained supervisor would be an important one.

A short time previous to this a supervisory training program had been put on at Detroit Receiving Hospital by the Detroit Civil Service Commission. It was decided that the material content of this program, with slight alterations to fit the Harper Hospital

situation, would be satisfactory. This program was instituted and carried to a successful conclusion. It will not be considered in further detail in this report.

The development of standard times for hospital jobs and the analysis of job content on the various jobs of the hospital was delayed until a future time. It was not felt that standard times for the hospital jobs, as they then existed, would have value in proportion to the amount of effort which would be necessary in obtaining the standard times. The only probable value would be for the purpose of evaluating the success of the study. It was thought that an estimate of the value of the savings of the proposed better methods would be sufficiently accurate for the needs anticipated. The analysis of the job content of the various jobs in the hospital was delayed only until it was possible to undertake this project. This was done later in the year and the results will be included in this report.

A study of the control procedures, in view of simplifying the paper work was not attempted by the committee, because at the time it was not felt that there was sufficient help available to carry out that phase of the project.

The above discussion outlines the scope of the industrial engineering project as it was conceived, in January of 1951 by the Industrial Engineers involved, after considering the existing situation at Harper Hospital.

CHAPTER III

REVIEW OF THE INDUSTRIAL ENGINEERING APPROACH WHICH WAS USED IN THE WORK AT HARPER HOSPITAL

A. The General Approach

From the very first, the Industrial Engineers concerned could see practically no difference between the situation at Harper Hospital and the situation which faced these same engineers in industry. It was decided that the approach to the problem, unless experience dictated otherwise, would be basically the same as would be used in any industrial situation where the end result was to find the most efficient means of operation.

In making the summation of the industrial engineering approach, it was thought best to discuss each time according to its position in the over-all picture. As can be seen by the flow diagram (See Figure 1) this problem of finding a more efficient means of operating was broken down into five phases.

1. definition of the problem
2. collection of the facts
3. analysis of the facts
4. formation of a new plan
5. implementation of the plan

I. DEFINITION OF THE PROBLEM

1. Statement of the overall problem.
   a. Patient Care Committee.
   b. Questionnaires:
      Patient
      Doctor
      Other hospitals
2. Definition of specific problems.
   a. Trouble spots.
   b. Observed violation of principles of motion economy.
   c. Suggestions from workers.
   d. Survey by industrial engineers.

II. COLLECTION OF THE FACTS

1. Verbal.
2. Written.
   a. Collation of available records.
   b. Memorandums kept by workers.
3. Diagrammatic.
   a. Process Flow Charts.
   b. Flow Diagrams.
4. Motion Pictures.
5. Work Sampling.

III. ANALYSIS OF THE FACTS

1. Movement.
   a. Distance.
   b. Time.
   c. Effort.
2. Morale.
   a. Satisfied.
   b. Dissatisfied.
3. Worker Specifications.
   a. Qualified.
   b. Unqualified.
   c. Over-qualified.
4. Questioning Attitude.
   a. What
   b. Where
   c. When WHY
   d. Who
   e. How

IV. FORMATION OF A NEW PLAN

1. Eliminate.
   a. Complete jobs.
   b. Unnecessary movements.
2. Combine.
   a. Two jobs at same time.
   b. Two jobs at one location.
3. Simplify.
   a, Change sequence.
4. Devise New Plan.

V. IMPLEMENTATION OF THE PLAN

1. Developing acceptance attitude.
   a. Participation.
   b. 3-dimensional layout.
   c. Interviews.
   d. Motion pictures.
   e. Training programs.
2. Changing physical situation.
   a. Cost analysis.
   b. Procurement of new materials.
   c. Making layout alterations.
   d. Selecting new equipment.

THE ABOVE ADDED TOGETHER GIVE:

MORE EFFICIENT OPERATION

1. Savings in Operating Costs.
2. Savings in Skilled Personnel.
3. Better Morale of Employees.
4. Better Care for Patients.

Fig. 1 The Industrial Engineering Approach to a Problem

It can be seen that there is nothing new or different about this approach. It is fundamentally the basic, scientific approach to any problem. For purpose of discussion each of these five steps is considered separately and the industrial engineering principles which were used in each step are discussed in detail.

B. Definition of the Problem

It was important when approaching the situation at Harper Hospital that there be an exactly defined problem to work on in all cases. In fact, many times it was found that when the exact problem was defined, the analyst had gone a considerable distance toward the accomplishment of the task.

It seemed that the problem at Harper Hospital broke down into two main phases.

1. The statement of the over-all problem which was to be considered.
2. The definition of individual problems within the over-all problem.

The statement of the over-all problem was outside of the scope of this report. However, it was briefly mentioned as it did have considerable bearing on the work that was done by the Industrial Engineering group. The original statement of the over-all problem was

not actually a statement but rather a realization that there was a need for study in the field of improving patient care and lowering the cost of patient care. Also, there was a need to supplement the supply of professional help, either by obtaining more professional help, or by better utilization of the help which was available. Soon after the original patient care committee was organized a formal statement of the problem was made and even this was very general. It was a lengthy report drawn up primarily by Miss Marion Wright (who had been appointed by the hospital as full time director of the over-all program) in which she listed all of the avenues of approach to this program which were apparent at that time.

One of the first things that became apparent was that there was very little factual information about the make-up of a hospital and the hospital's chief product which was the well patient. With the cooperation of the School of Business Administration at Wayne University a series of questionnaires were distributed, collected, and analyzed. These helped to better define the over-all problem. These questionnaires covered three fields:

1. Patients -- to find out how they felt about the situation as it was, and also what they thought the situation should be.

2. Medical staff -- to determine their reaction to the project and to obtain any suggestions they might want to offer.
3. Other hospitals -- to determine their comparative situations and to draw on any experience they had accumulated.

As a result of these original steps, a rather clear definition of the over-all problem emerged, and at this point a similarity between the problems that faced the hospital and those which were confronted by industry as a whole, also emerged. When industry was confronted by such problems, it turned to the Industrial Engineer and utilized his knowledge of the solving of industrial problems in order to obtain more efficient operations. With this in mind the Harper Hospital Industrial Engineering Committee was organized.

One of the first acts of the Industrial Engineering Committee was to try to define some of the individual problems which they could work on. A general tour of the total operations had been made by the Industrial Engineers with the operation as a whole but also so these trained observers could notice violations of the principles of motion economy. Several distinct violations of these principles were observed

and were noted for study and some of these studies are included in the body of this report. Also, to help in defining the individual problems it was made known throughout the hospital that suggestions would be accepted from any and all interested parties and these suggestions were then analyzed in order to further define the situation.

After a list had been made of individual problems which would warrant the attention of the Industrial Engineering Group, a meeting was held and these problems were given priority as to the order in which they would be approached and then the individual approaches were made.

C. Collection of the Facts

After a particular problem has been defined it is necessary that all facts surrounding this situation be collected. There are many techniques which can be used and which are used by practicing industrial engineers. The following techniques were used to solve problems at Harper Hospital.

First, the technique of verbal interviewing was used to a great extent. This problem of applying the principles of Industrial Engineering to a hospital situation was unique in that the people working

at the hospital were not familiar with the analysis techniques used, as are the workers in industry. It was felt that the verbal interview would have a two fold purpose. First, it would acquaint the worker with the purpose behind the collection of facts. Second, the opinions of the workers could be obtained at the same time as any information which they might have pertaining to the individual problems.

Written records were used to a great extent for collection of the facts. It should be stated that it was found that the hospital kept more records than the normal industry with which most of the industrial engineers were familiar. There was a great volume of potential useful information which was kept as a matter of pure record. However, it was the job of Industrial Engineers to determine what records could be utilized in order to come up with a plan which would result in more efficient operations. Therefore alot of information concerning individual problems was obtained from the formal records of the hospital.

Also it was found that due to the high level of intelligence of many of the hospital personnel, they could be depended upon to provide very accurate written memoranda concerning a particular subject and this technique was utilized to a great extent because

again it was felt that the participation of the worker in the collection of the facts would be a great help when this particular worker was asked to participate in a new plan.

The diagrammatic techniques of industrial engineering were also used to considerable extent as has been demonstrated in the body of this report. Since these techniques are familiar to all industrial engineering personnel they will not be discussed at length in this report. The Flow Diagram, The Process Flow Chart, Gantt Type Charts, Man-Machine Charts, and Procedure Charts were used with success in this program.

The motion picture also was used for this study. It was used not only because it is a valuable tool in collecting facts but as this was a project in a field where the principles of industrial engineering had not been previously applied, it was thought that a permanent visual record would be of value in selling the total program. This was found to be true.

The technique of work sampling, also known as statistical ratio-delay studying, was really a diagrammatic industrial engineering technique. However, because it was a new technique and was so well adapted to play a major role in the study at Harper

Hospital, it has been considered as a separate item in this report. It was noted that not only did the work sampling technique show that the principles of industrial engineering could be applied to the hospital situation, but the use of the work sampling technique in the hospital situation showed that work sampling was an ideal tool to use in an over-all survey of any non-repetitive job.

D. Analysis of the Facts

The next step in the industrial engineering approach was to make an analysis of the facts which had been collected. The work of collecting the facts doesn't help at all in the direct solution of the problem. Many organizations have collected a large number of facts and yet have failed to benefit by this labor. Value will be received from this work only if the collected facts are properly analyzed.

The first step of the analysis perhaps was not analysis at all but a refinement of the collection technique. This part of the procedure might have been included in section two under collection of the facts. However, since it was a phase which was performed only by those people who were going to make a detailed analysis, and was the first step in

differentiating a proper analysis of the facts from a mere collection of the facts, it is included under the phase of analysis of the facts.

This step was the collection of the facts and the sorting of these facts into their respective position in order to get a properly balanced picture of the job which was being analyzed. Not only was there a sorting and a collation of the facts, but also a certain amount of judgment was used at this time in order to decide which facts were pertinent and which were merely extraneous facts relating perhaps, to the total situation but adding no value to the analysis which was anticipated. A great deal of judgment was required in the accepting or rejecting of facts to be used. Items which appeared to have no value to the untrained analyst may be very significant, in fact, may be the key to the situation when viewed by a qualified analyst trained in the principles of motion economy and in the other industrial engineering techniques.

After the facts had been sorted properly and gathered together into their respective positions in the total picture, the next step was to make a detailed analysis of each of these facets of the total situation. In making the detailed analysis each

individual item is considered in terms of the following:

What?

Where?

When? WHY??

Who?

How?

This approach which was used seemed like a very simplified approach to a difficult problem but, when properly followed in the correct order, it gave a very clear and concise analysis of all the situations which were encountered. There is a very definite order in which these questions should be asked and it is in this order that they will be discussed.

First, what was being done and what was the purpose of doing it? Why should it have been done? These questions determined the value or the useful purpose of doing the particular detail which was being considered. It was determined if each detail did what it was supposed to do and also why it should have been done. Dr. Lillian Gilbreth once said, "Entirely too many operations are studied that should never be done at all." Therefore, this question was never dropped until it was determined that it was absolutely necessary that the detail should be performed. The question of what

was being done was always considered first because if a detail could be eliminated there was no need to further analyze that portion of the operation.

Next, where was the detail being done? This was considered in the light of where was the best place to do the detail? Why was it done there? These questions were asked to be sure that if the detail was necessary that it was performed in the right place.

When was the detail done? When was the best time to do the detail? And why was it done then? These questions were asked to be sure that if the detail was necessary, that it was done at the right time. It was also asked at this point if it were not possible that this detail could be performed at the same time as some other detail. Or if it was possible to perform it before or after other detail in order to make the operation more efficient.

Who did the detail? Again this question was asked in light of who should have done the detail? And why should this person have done it? This question was especially apropos in the work at Harper Hospital. A major consideration was the determination of whether or not the work being performed on a particular detail was being performed by a person who was qualified to do that work, or a person who

was unqualified to do the job, or a person who was over-qualified to do the job. When it was found that a job was being performed by a person of higher skill than was necessary for that particular task, a person of lesser training was utilized to perform the task.

How was the detail performed? And why was it done that way? In analyzing the detail in light of this question, such things were taken into consideration as; the distance traveled in performing the task, the time necessary to perform the task, the effort put forth in order to perform the task, and whether or not a satisfied or dissatisfied patient resulted from the performance of the task. Also, the morale of the person performing the particular task was considered. In many cases a change in the job improved the attitude of the person toward that particular job.

In order to help the analyst do a better job of analyzing each function a motion economy check list was used in order that they constantly would be cognizant of the points that should be considered. This motion economy check list served to point out that very few jobs were anywhere near perfect and that each and every job should be questioned. The attitude was developed that all jobs could be improved. It was proposed to develop this questioning attitude to a

point where each individual considered the good of the entire organization rather than that of any one department or any one individual. The cultivation of this attitude eliminated useless and unnecessary work. It determined where and when the work could be most economically performed, and it evened out the flow of work. It was very important that the people making the analysis maintain an open mind. In order to improve an operation it was necessary that the people concerned actually believe that it could be improved. In order to get real constructive results from each analysis, all of the separate steps had to be honestly questioned.

E. Formation of a New Plan

In the formation of a new plan to perform a particular job in industry, it was found that the problem usually resolved itself into one of two classes. The first way of developing a new plan was considered a revolution and the second way of developing a new plan was considered evolution. In the first case there was a total revision of the basic process, a radical departure from the previous method of performing the job. While in the second case the same basic process was continued but the process was improved so

that it could be performed in a more efficient manner.

In the work at Harper Hospital the first method of planning, that of revolution, was not used to any great extent. There were two reasons for this:

First, the Industrial Engineers working on the Harper Hospital project did not feel that they were qualified to criticize the basic processes used in the hospital field. No member of the Industrial Engineering team that worked on the project had any training in medical procedures or practices and in the course of this project it was not deemed possible for the members of the committee to spend the time necessary to gain such knowledge. Furthermore, for the purpose of the project as it was established it was not thought that such a step was necessary or even prudent at this time.

The second reason that the revolution technique was not used at Harper Hospital was because it was thought that such a step might jeopardize the status of the entire project. It was the attitude of many people in the hospital field that in order to make improvements in their field it would be necessary to change the basic processes that were being used. These people had established, because of fact or

tradition, that because they were dealing with the lives of human beings in hospital work, certain ways of performing a task were almost sacred, and no one should tamper with the basic method. It was not the purpose of this project to challenge the wisdom of such an approach but it was the purpose to consider how this point of view of many hospital people affected the project. It was thought that because of such a point of view it would be foolhardy for the Industrial Engineers concerned to attempt to make a change of any basic process in view of the almost certain flood of criticism which such a move would bring about.

The basic purposes of this project were to show the hospital people that the principles of industrial engineering could be applied to a hospital situation; to win the enthusiastic support of the hospital people for a continuation of such a program at Harper Hospital; and to spread the use of these principles to other hospitals throughout the country. It was brought out that it was the experience of the Industrial Engineers concerned that the use of the evolution technique brought forth less resistance in most cases from the top management people than did the revolution technique. This was because the top management people were responsible for a new method regardless of who

put that method in effect. Therefore they have a measure of security in maintaining the same basic processes that have been used in the past.

In forming a new plan it was noted that all productive tasks were made up of the following three parts. First, was the "make-ready." In the "make-ready" for the job were all of the elements which were necessary to get the materials and the tools and the persons in the position to perform a particular task. The second part of the task was the "do." The "do" part of the task was the actual performance of the task. A "do" operation usually added progress to the task or provided a service for someone. The third step in any operation was the "put-away." The "put-away" was as the title implied the placing of the object or objects in the proper location or the removal and storage of tools, equipment and/or personnel.

An analysis of the above steps showed that the more efficient job had a minimum of "make-ready" and "put-away" and a maximum amount of effort went into the "do" operation. In the industrial situation this has been carried to the ultimate in some factories where an automation program has been carried out. In such a situation the work is automatically passed from

one "do" operation to the next "do" operation and the "make-ready" and "put-away" has been virtually eliminated. This was the aim of the planners of all operations. However, in the unmechanized work encountered in the hospital field, such a solution was merely a goal and was seldom realized.

There were four distinct steps which were followed in evolving a new plan for performing an existing process. The first was to look over the existing plan and eliminate any "do" operations which could possibly be eliminated from the old method. If "do" operations were eliminated, all of the operations, transportations, and storages concerned with the "make-ready" and the "put-away" which applied to that particular "do" were automatically eliminated. The easiest details to challenge in most cases were the transportations and the storages. Whenever backtracking of work, heavy lifting or carrying, bottlenecks, or skilled people doing unskilled work, the question was asked, "Can this work be eliminated?"

Secondly, after all possible details were eliminated, a check was made to see if it was possible to combine any of the operations which remained. This combination of operations often resulted in the performing of the total amount of

labor for the cost of performing one of the operations previously. Likewise it was possible in many instances to combine transportations and storages so that they were performed by the same person or piece of equipment. Combining operations also improved the quality of the operations in some instances because of the benefit derived from the interrelationship. At times mistakes and delay between operations were eliminated when there was a combination of operations.

Thirdly, after all possible operations were eliminated and feasible combinations were made among those remaining, a check was made to see if it was possible to change the sequence of the operations in order to accomplish the task more efficiently. By changing the sequence of an operation it was possible to eliminate back tracking or duplication of effort in many cases. Sometimes the order in which the operations were performed was necessary to the process, however there were many instances when a change of sequence could be made with real saving.

The fourth step that was taken in developing any new plan was to simplify any operations which were determined to be necessary for the performance of the task. Note that this step of simplifying the work was taken only after all possibilities for

eliminating, combining, or changing sequence of work had been exhausted. Unfortunately it was found that the majority of untrained people intending to improve an operation will attempt to simplify the operations as the first step. Usually this resulted in a stirring up of the bad methods rather than any distinct improvement.

F. Implementation of the Plan

There are three basic factors to be dealt with in putting any new plan into effect. These are:

1. The preparation of the suggested methods change.
2. The technical changes and or problems involved.
3. The human problem involved.

In preparing the suggested methods change, it was necessary to test the basic plan which was developed in step four in our analysis technique and work out the details which had to be answered before the plan could be put into effect. Such problems as the following had to be considered and answered if the new plan was to accomplish just what the planner had in mind when the plan was evolved:

1. Will other supervision be affected?

2. Will new equipment be required?

3. Will the change require stoppages in operation during the change-over period?

4. What staff or service departments will be involved in the change?

5. Will the change require a higher skilled operator?

6. Will a lower skilled operator be capable of performing the new task?

7. What is the cost of the proposed change?

8. Will the present operator accept the new method with the proper enthusiasm?

9. Will the present operator or any new operators need special training to perform the new method?

10. Will the new methods require additional study as to manpower requirements?

11. Will the new method reduce over-all cost, improve quality, reduce mistakes and scrap and improve efficiency?

It was not only necessary to consider these questions and to arrive at satisfactory answers but it was necessary that these answers be recorded and the information made available to those people requiring the information to implement the new plan.

As many of the plans required technical changes in equipment and building facilities, it was also necessary that the following problems be considered and answered before the new plan could go into effect:

1. Will the suggested change require more floor space or less floor space?

2. Will the suggested change reduce the amount of movement and effort required to handle the materials involved in the operation?

3. Will the tools and materials be located in such a manner that they can be used most efficiently?

4. Were the principles of motion economy considered in making the physical changes?

It was also necessary in all methods changes to consider the human factor. Frequently this was more important than all of the mechanical and technical problems involved. It was recognized that any person could make a mediocre plan work efficiently if he was enthused about the plan and had a desire to make it work efficiently. Also most persons would make a good plan work poorly if they were not in agreement that the plan should have been put into effect. It was always remembered that any time a job was improved it was an inference that the person who was doing the job previously was not doing as good a job as was possible. Naturally, this created a certain immediate resentment on the part of the person towards any methods change. It was known that it is a trait of all people that they resent change and yet that they like progress. It was the job of the Industrial

Engineers to see that the person was properly conditioned so that the trait in the person which desired progress overpowered the trait which resented change. In the work at Harper Hospital a simple list was drawn up and used as a guide in approaching people about the method plan. It was felt that if these rules were followed a minimum of resistance would be incurred. They were as follows:

1. People like to be in on the know. Always keep the personnel informed in advance of anticipated changes.

2. People will usually support an idea that they have had a part in forming.

3. People like to buy. They do not like to be sold.

4. People fear, or are suspicious of, things that they do not understand.

5. People resist change unless they can see a personal benefit in changing. Be sure to always explain the benefits of new ideas.

6. People want to be recognized. Give the person proper recognition for his part in any new plan.

7. People like to give advice. Each person is an expert on his own job. Always ask for his advice.

8. Most people feel that their skill and knowledge is best. Don't insult a person because he has been using an obsolete method. He probably was very skillful at performing the obsolete method.

The above guides were followed in spirit as well as in fact during the entire study at Harper Hospital and it is felt that there was a minimum of resistance to the changes when they actually took place.

The actual mechanics of changing a method at Harper Hospital were not changed from those which had been in effect previous to this study. The established line organization was utilized in all cases for putting plans into effect. There was close supervision and a considerable amount of guidance by the Work Simplification Committee as to how the implementations should take place; but at no time was the line authority superceded in the actual performance of the duty.

CHAPTER IV

THE INDUSTRIAL ENGINEERING PROJECTS

A. Method of Presentation

It is the purpose of the body of this report to present in detail representative examples of the projects which were undertaken by the Industrial Engineering Committee at Harper Hospital. It is thought that the most effective way of making such a presentation will be to take each project and carry it to a conclusion as a separate section. Also there will be a discussion of how the various units were coordinated into the effective program which has resulted.

B. The Work Simplification Training Program

As was stated in the opening section of the report, it was considered by the Industrial Engineers serving on the Harper Hospital Improvement of Patient Care Committee that one of the most important considerations in the entire project was the problem of insuring that the methods improvement program was to be a continous one. If it was to be an active program only while the outside experts were on the job, and

would die from lack of stimulation when their enthusiasm had been removed, the total program would have to be considered a failure.

If this program was to be a continuous program it would be necessary for people within the hospital organization to thoroughly understand the program and to be skilled enough in the use of the approach which was proposed so they could continue the project on an ever growing basis.

Probably the greatest proponent of the need for properly trained people in the use of industrial engineering is Allen H. Mogensen, Director of the Management Training Clinic at Lake Placid, New York. Work Simplification is a term which was coined by Mr. Mogensen and it aptly fits the concepts which he proposes.[4] Work Simplification is a way of improving work output in an organization with a minimum of capital expenditure. It is a combination of the principles of scientific management, industrial engineering, salesmanship, and plain common sense.[5]

It was decided that the term, Work Simplification, could be well adapted to the work which was being attempted at Harper Hospital. It was a clearly accepted fact that the time of telling people how to do a job was past. This has been shown by the

successful efforts of the unions and labor in general to resist or circumvent organizational mandates. Only if there is a change in the sentiments of people involved in the change, will that change be entirely successful. And in industrial engineering it is necessary to work constantly on the theory that the best method in the world is useless unless it is used on the job as it was intended that it should be used.

All people have a basic fear of change. This fear is aggravated in the lower class of workers because of their position in the social stratum. The ordinary worker is at the bottom of the heap and he is nearly always in the position of having to adjust himself to changes which he does not have a part in initiating and which he does not understand. Add to this, the fear of being completely displaced from his job by the specter of the push-button factory and it is easy to see why workers resist new methods.[6]

Top management is prone to resist new methods too, and fundamentally it is the same basic fear of change which affects our top management.[7] However, the approach to top management is somewhat different than the approach that is made to the rank and file workers. Top management usually recognizes the need

for change to a greater extent than the worker. But still they have a basic fear of the unknown and so the job in top management usually in one of gaining a complete understanding of the principles and applications which the industrial engineer is going to use.

Recognizing the fact that the sentiments of the people involved in the methods change must be altered it is evident that if a methods change is to be successful you must sell the idea to the users. Allen Mogensen advocates that the best way to sell a person on a methods change is to consult the person involved. Not only does consulting the person involved in the methods change help to sell the person on the change but alot of valuable ideas will be discovered by talking to the person who is doing the particular job. It is a fact that no one knows the job as well as the man doing that job.

The expert approach is no doubt a very prompt and efficient way of developing better methods. However, when the better methods are impressed on the workers the results are not always as anticipated. The consulting approach takes more time than the expert approach in the initial applications, however each applications results in more confidence and enthusiasm on the part of all people involved. As a

result, the original extra time investment is more than repaid in future savings.

A very definite point should be made of the necessity of having top management support for any work simplification program. A policy statement should be made by top management, to all employees, that no person will be displaced due to a methods improvement in a case of a change in a basic process. Such major changes should be thoroughly discussed with the workers involved. Usually all people displaced can be absorbed by the labor turn-over. Top management also must realize that a major change in employee attitude is necessary to institute a successful work simplification program. This change in attitude will require the concerted effort of all levels of management as well as a considerable amount of time.

In order to demonstrate to management the importance of their position in the training set-up it was decided that the first series of classes would be composed of the top people in the hospital group. Not only was it deemed necessary that these people should become acquainted with the industrial engineering approach as it was to be applied to the hospital situation, but these people would have to give their

ardent support to the program if it were to be a success at Harper Hospital.

As a result of the above discussion a training program was worked out and presented to a "pilot" group composed of the following people:

Mr. George Cartmill, Associate Director, General

Dr. Donald McKinley, Associate Director, Medical

Mr. Joseph Rourke, Associate Director, Out Patients' Service and Buildings

Miss Marion J. Wright, Associate Director, Special Studies

Miss Lucy D. Germain, R. N., Director of Nursing Service and Nursing Education

Miss Mary M. Harrington, Director of Dietetics and Dietetic Education

Mrs. Martha J. Ballard, Executive Housekeeper

Mr. Harvey Caddell, Administrative Assistant, Building and Plant Department

Miss Margaret O'Connell, Administrative Dietitian

Mrs. Esther Ashton, Associate Director of Nursing

Miss Margaret MacLean, Instructor in Nursing, Medical and Surgical Nursing

Miss Jayne Walters, Unit Kitchen Dietitian

It should be noted that the people on the above list are top management people. It was thought that, if people in such positions as these, could be put

through the training course, and be thoroughly convinced of the value and of the need for the Work Simplification Program, the program, itself, would be well on its way toward success. These people were in a position where they could exert a maximum of influence on the attitude of all of the people at Harper Hospital. Conversely, these were the people who, if they did not ardently support the program, could put a damper on the entire program.

The Work Simplification Training Program at Harper Hospital was started in May of 1951. The detail of the training program is not to be covered in this report. It is felt that the detailed information on the principles of industrial engineering has been sufficiently covered in standards texts.[8] However, a skeleton outline is given in order to show what information was covered in the course. This outline follows:

Session I. Introduction to Work Simplification

A. Outline of the course.

B. Aims of the course.

C. Need for the course in the hospital situation.

D. Progress in work simplification in the hospital field to date.

Session II. Arouse Interest in Work Simplification.

A. Demonstration of motion economy by the use of the peg board.

Session III. How to Pick a Job to Improve.

A. Developing an awareness that most jobs can be improved.

B. Practice in spotting ineffective methods.

Session IV. Principles of Motion Economy.

A. Presentation of the principles of motion economy.

B. Practice in using the principles of motion economy.

Session V. How to Analyze a Job.

A. Process Flow Chart.

B. Demonstration of Process Flow Chart.

Session VI. Practice in Using a Process Flow Chart.

A. Group participation in making a Process Flow Chart.

B. Discussion of the chart and the principles involved.

Session VII. Process Flow Chart Review.

A. Review of the use of the Process Flow Chart.

B. Presentation of the Flow Diagrams and Work Station Sketches.

C. A discussion of charting complex problems.

D. Need for the use of trained personnel to assist in solving complex problems.

Session VIII. Analyzing a Job.

A. Discussion of what, where, when, who, how, and why.

B. Discussion of eliminate, combine, and simplify.

C. Review of the above in connection with the Flow Process Chart.

Session IX. Developing a Better Method.

A. Discussion of using the principles studied to date in developing a better method.

B. Demonstration of developing a better method.

Session X. Developing a Better Method.

A. Practice in developing better methods.

Session XI. Preparing Proposals for Improvement.

A. Importance of proper preparation of proposal.

B. Practice in preparing proposals.

Session XII. Applying the New Method.

A. Technical problems in applying a new method.

B. Personnel problems in applying a new method.

C. Selling the new method.

D. Follow-up and control of new method.

E. Analyzing the results of a new method.

Sessions XIII and XIV. Discussion of Proposals for Improvement.

A. Each member of the training group will prepare a proposal for an improvement

in his or her own personal work area. Note: This should be brought to the group's attention several sessions in advance in order that they shall be prepared.

The first series of training classes was conducted by the Industrial Engineers who were working on the project at Harper Hospital. In line with the stated intention that Harper Hospital should take over the program as quickly as possible, Miss MacLean of the School of Nursing, and Miss Walters of Dietetics, as noted on the original class roll, were trained to take over the future Work Simplification Training Classes at the hospital. The first sessions were finished in July of 1951. In September of 1951, two additional groups composed of the next level of management in the hospital were started with Miss MacLean and Miss Walters as conference leaders. In order to assist these leaders a weekly meeting was held with members of the Industrial Engineering group in order to help arrange the coming sessions and to discuss points of interest which had been brought up in the previous sessions. When this second round of sessions had been finished it was decided that the hospital people were capable of carrying on with this phase of the industrial engineering program themselves. Since then, several additional groups have been put

through the training program and it is the intention of the hospital people to continue the Work Simplification Training program until all people at Harper Hospital are completely informed as to the purpose and the principles of the Work Simplification concept. If the Work Simplification program is to have maximum effectiveness it is necessary that the people who take the training program not only submit a proposal for use in the class on Work Simplification but that they continue to submit proposals on improvements throughout their working career. In order to see that this occurs, there should be set up a permanent organization for the handling of proposals and the trainees in the Work Simplification Training program should be made aware of the functioning of this part of the organization. A discussion of how this was accomplished will be taken up as the next part of this report.

C. The Work Simplification Organization

It was emphasized in the first part of the report and again in the discussion of the Work Simplification Training program that the application of the principles of industrial engineering to the Harper Hospital situation would be a success only if there was a continuance of the program and an expansion of

the program even after the consulting engineers had left the scene.

The first step in implementing this idea was the Work Simplification Training Program, in which it was proposed that all people in the hospital, who would be affected by the program, would learn the basic principles of industrial engineering as they were to be applied. As part of this Work Simplification program each participant was required to make a proposal for improvement within his or her work area. The reason for this proposal for improvement (See Figure 2) was three-fold. First, it was hoped that there would be definite savings realized in the operation of Harper Hospital through these proposals for improvement. Secondly, the preparation of a proposal for improvement and the following through with the installation of the improvement would force the participant to apply the principles which had been discussed in the early sessions of the Work Simplification Training Program. As a result of applying these principles the participant would gain confidence in their application. Thirdly, the participant in the Work Simplification Training Program would receive instructions and practice in the operation of the proposal system. The participant would

No.

HARPER HOSPITAL

SUBMITTED BY: _____ DATE: _____

DEPARTMENT NO.: _____ Phone Ext. _____

To: (Immediate Supervisor) _____

COPY TO:

LEAVE BLANK

No. _____

Rec'd _____

DESCRIBE YOUR PROPOSAL: Be Brief; don't elaborate--just jot it down.

(Space on Reverse Side for Supervisor's Comments)

(Make out Process Flow Charts on the Present and Proposed Methods, along with any drawings, sketches, etc. which would make your proposal easier to understand. Attach this material to the original of this form only.)

discover that there was a very definite tie-in between the Work Simplification Training Program and the Work Simplification Organization which was set up at the hospital.

In the original discussions of the over-all program this point was repeatedly emphasized; it would be necessary that all participants in the Work Simplification Training Program understand that if the total program is to be a success their submission of proposals for improvement will not stop after the one required proposal is made during the training sessions. In other words the program had to have a backing from some particular office or place in the organization so that, after the participants in the Work Simplification Training Program had graduated, they would have an office whose primary duty was to work with them in order to expedite future proposals.

It was decided that for the present time this authority should be vested in the office of Miss Marion Wright, Associate Director of Harper Hospital. However, the actual function of running the program would be carried out by a committee of five people.

It was decided to use this committee approach for two reasons. One, at the present time the program was not sufficiently far advanced so that it was

thought that a separate operating department could be established. And secondly, it was thought that in view of the necessity for selling the entire program, that the inclusion of some of the major operating heads on the directing committee would strenghten the program as a whole. Accordingly, a committee was set up with Miss Wright as chairman and including the following people:

Assistant Director of Nursing

Administrative Dietitian

Housekeeping Supervisor

Maintenance Representative

Work Simplification Conference Trainers (three at present)

It should be noticed that included in the personnel of the committee were people from the main departments which would be instrumental in submitting the majority of proposals. Figure 3 is a flow chart of the presentation of a typical proposal and its path through the organization.

There were two types of proposals which were encountered. First, was the type of proposal which affected a change in procedure or layout of one particular department and which affected no other department. This type of proposal, especially if the

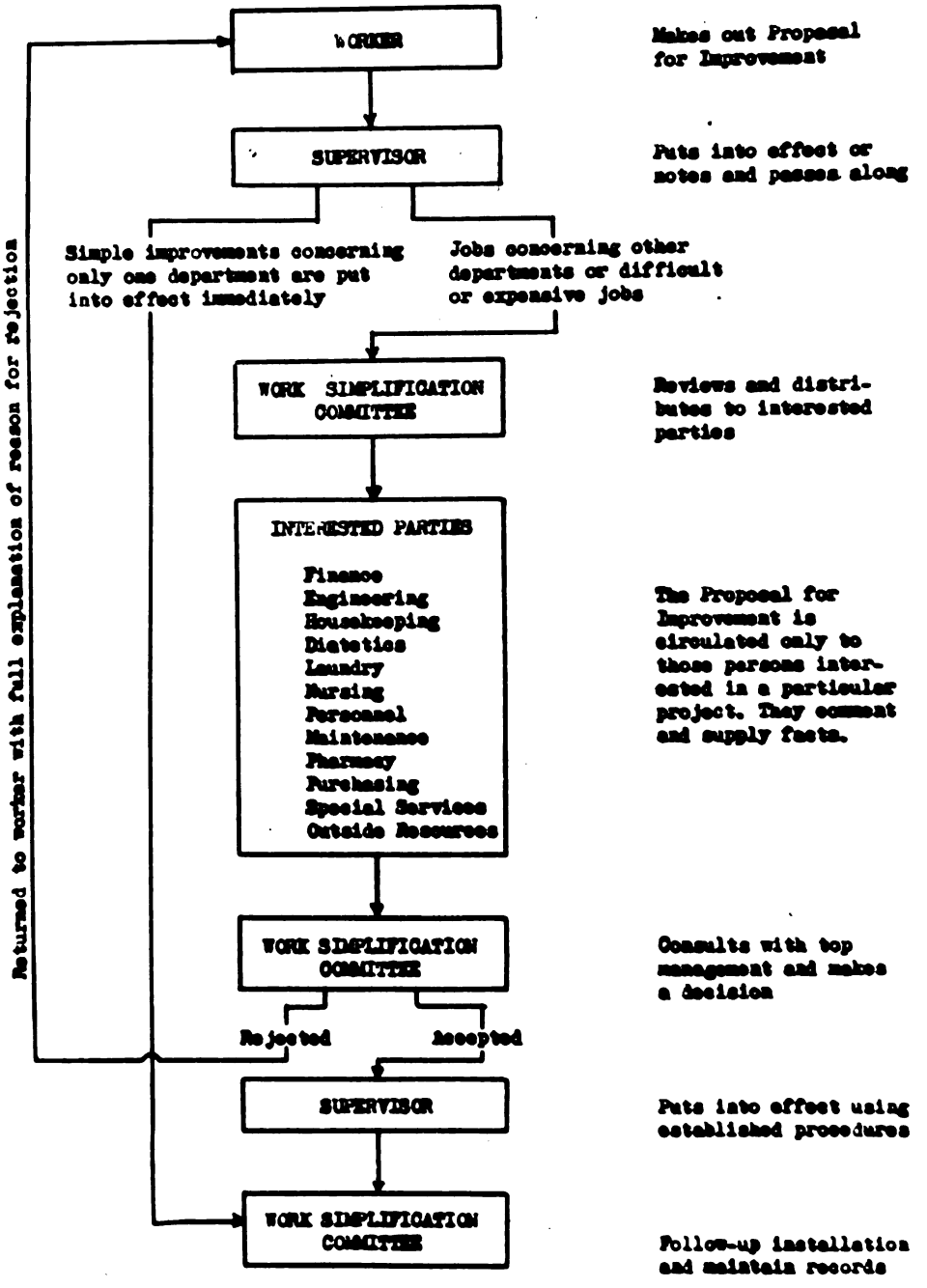


Fig. 3 Flow Diagram of Procedure for Submitting a Proposal for Improvement

expenditure was low, was implemented by the person making the proposal, cooperating with the departmental head. In this case a record of the proposal was sent to the Work Simplification Office only so that the entire history of the program could be properly kept at a central location. The Work Simplification Office did not intend to assume any authority which was formerly held by individual departments, in fact it encouraged the assuming of more authority by these individual departments. The skill acquired by the people associated with the Work Simplification Office from the handling of proposals in the many departments was utilized by the various departments on a consulting basis. However, anything that could be handled by a particular department was not officially considered by the Work Simplification Office unless help was specifically requested by the department involved.

The second type of proposal which was encountered was that type of proposal which involved more than one department or a large amount of study and analysis and/or a large capital outlay for equipment or facility changes. This type of proposal was submitted through the worker's immediate supervisor and thence to the Work Simplification Office. The

Work Simplification Office distributed copies of the proposal to the various interested persons and got their reaction and then the entire proposal was submitted to the Work Simplification Committee. The committee then called any interested departments, persons possessing special skill, requested outside advice if necessary, and in short coordinated the entire study, and then made the final decision as to the adoption or rejection or modification of the proposal.

The Work Simplification Office also implemented the installation of the proposal in that it was responsible for notifying the proper parties that they should take action. With Miss Wright, Associate Director of Harper Hospital, as chairman of the committee, it is well within the powers of this committee to take such action.

D. The Pharmacy Delivery Service

One of the first things which was noted at Harper Hospital by those concerned with the improvement of patient care was the fact that alot of skilled people seemed to be traveling from place to place in order to get some object or to perform a small task. The Industrial Engineers noted this

great amount of walking as an indication of a potential saving of time. It was thought that perhaps some of the walking could be eliminated.

In the initial discussions about the problem and after interviewing some of the floor personnel to obtain some evidence upon which a study should be based, it was found that by far the greatest single type of errand which was carried out by the floor personnel was the making of trips to the pharmacy to pick up drugs for administering to the patients. It was decided that in order to get some work under way immediately, a pharmacy delivery service would be established.

The people connected with the operation of the pharmacy held a meeting and decided that a central pharmacy delivery service could be set up. Routine deliveries to all floors would be made by a delivery man pushing a cart from floor to floor. This cart was loaded with a supply of drugs needed at the various floors. Also it was decided that all standard drugs would be stocked at the various locations and that these stocks would be replenished automatically by the pharmacy delivery man. In order to do this it was necessary to set up standards for all of the various drugs on each floor. This was

done by a head nurse on each floor after examining her past usage records.

This delivery service was started and it was found that one man could make the complete rounds of the hospital in three hours. It was estimated that sixty-eight hours per week of floor personnel time was saved. This was a partial fulfillment of one of the original objectives of the project. Previous to the establishment of the delivery service, a check showed that approximately twenty trips were made to the pharmacy each day and that each trip averaged about thirty minutes.

As will be seen by the study which was made before establishing the general messenger service, there were some trips to the pharmacy for emergency orders or for special orders which should not be handled by the delivery man. But all people concerned with the pharmacy delivery service feel that this service is a worthwhile and profitable one.

As a direct result of the establishment of this delivery service by the pharmacy the people connected with the pharmacy became interested in the problem of saving time, and on their own initiative have gone ahead and made two further improvements in their service to the rest of the hospital. First,

they have worked out a system of pre-packaging almost all of the standard medicines that are used throughout the hospital (See Figure 4). Secondly, they have found that many of the medicines which were used can be supplied in larger units than had been used in the past and that this has resulted in a saving of both time and packaging materials to the hospital at large. This point should be noted because that is a manifestation of the attitude that it was hoped would be established at Harper Hospital as the result of this industrial engineering work.

E. The Central Messenger Service

It was thought that before a general messenger service was established, an activity study of the hospital at large should be made in order to determine just what type of a messenger service should be established and how effective it would be. It was decided that such a study could be made by the floor personnel themselves. The purpose of the study was explained to the nurses and head nurses on four representative floors of the Harper Hospital and they agreed to keep a record of all errands which took them off of their own floor. This record was kept for a period of two weeks.

Fig. 4 Prepackaged Drugs in Pharmacy Awaiting Delivery to the Units

It was thought that the four floors selected were representative of the hospital as a whole. In these four floors were a total of 103 beds or 18.6% of all beds at Harper Hospital. Table I was made to show in condensed form the results of this study.

As a result of this study it was decided that a central messenger service should be established. A central messenger service was established within the communications section of the hospital. The service was under the direct responsibility of the chief telephone operator.

A check was made on the messenger service after it had been in existence for eight weeks and for the eighth week it was found that the messenger service handled 1,813 errands of which a study showed that at least 1,400 would have been made by floor personnel. In addition to this the messenger service handled 315 admissions and 339 discharges; these duties have been taken over by the general messenger service. The messenger service also has taken over the job of staffing the ambulance entrance. This had previously required three people to cover the three shifts.

In order to provide the above services, twelve full time messengers were employed. These jobs were

TABLE I

TWO-WEEK SUMMARY OF "OFF-FLOOR" ERRANDS

(Four typical floors - 18.6% of total beds)

	PHARMACY	CENTRAL SUPPLY	B.M.R. - E.K.G.	OPERATING ROOM	LABORATORIES	BLOOD BANK	CASHIER'S OFFICE	DISCHARGING	LAUNDERY	MAINTENANCE	PHYSIOTHERAPY	RECORD ROOM	X-RAY	OTHER FLOORS	TRANSFERS	TOTAL
Nurse	15	10		215			5	10							15	270
Practical Nurse		11		85	16		18		35				5			170
Orderly	5	977	107	15	30	40	15	48			201		57	60		1555
Ward Helper	70	466	25	20	133	66	10	113	85	20			6	115	20	1149
Ward Clerk	72	96	15	5	82	79	30	50	5	16	27	41	15	40	10	583
TOTAL	162	1560	147	340	261	185	78	221	125	36	228	41	83	215	45	3727

PROJECTED TO ENTIRE HOSPITAL FOR ONE WEEK

Nurse	726 minutes =	12 hours, 6 minutes
Practical Nurse	457 minutes =	7 hours, 37 minutes
Orderly	4180 minutes =	69 hours, 40 minutes
Ward Helper	3088 minutes =	51 hours, 28 minutes
Ward Clerk	1567 minutes =	27 hours, 7 minutes
TOTAL	10018 minutes =	166 hours, 58 minutes

(This equals approximately 4.17 men for 1 week)

filled by people with practically no training, except for an orientation to the hospital situation. Many of the messengers were college students worked together to handle a shift.

Another check also was available on the efficiency of the messenger service in that the messenger service was established during the same week in which the work sampling study of the activity of floor personnel was made. The work sampling study had been going on for two days when the messenger service was established. During those first two days a few errands were noted, but by the end of the work sampling study, one week later, there were practically no off the floor errands being performed by the personnel under study.

F. Linen Cart Exchange Service

One of the principles of better materials handling is that material should not be rehandled unless absolutely necessary. The ideal flow of materials is where a material is received into the plant and is moved once, directly to the point of use.[9] It should be used immediately or if storage is necessary, it should be stored at the point of use so that the person who will ultimately use it,

will be able to get it without additional handling. This ultimate goal is not always reached. There are other problems such as insufficient storage room at the point of use, control of materials received and disbursed, and maintenance of inventory, which may call for modifications of the above principle. However, the ultimate in efficient operation would be realized if the above were adhered to strictly.

The Industrial Engineers in their initial observations of the hospital noticed that there was one flagrant violation of the principle of minimum rehandling. This was the handling of the linen between the laundry and the point of ultimate usage, that is the patients room. The handling of linen in a hospital as large as Harper Hospital is a major problem, so any savings, however slight percentage-wise, would be rather large. Therefore, it was felt that this problem was of a magnitude which justified a rather careful analysis. The volume of flat linen, which was the object of this study, was about five tons per day.

The point that caught the attention of the Industrial Engineers was the multiple storage system used in handling the linen. A cursory study of the

problem indicated that a Flow Process Chart would probably be best adapted to the solution of this problem, so an analysis of the problem was made, using a Flow Process Chart. (See Figure 5.)

As can be seen from examining this chart, the original study included only that portion of the linen cycle after it was passed through the mangle and until it had been placed on the patient's bed or in the patient's room. The return of the dirty linen was not studied at this time, because the dirty linen was being returned from the various floors to the laundry by placing it in bags and dropping it down a chute. This chute led directly into the sorting room in the laundry, then the linen was taken through the washing and the drying cycle. The laundry was set up according to standard commercial practice and appeared to be rather efficiently operated, so it was thought that a study of this portion of the cycle was not justified at this time.

As can be seen by reference to the chart, the linen was being handled as follows: Starting with the linen as it came from the mangle, it was first placed on a large cart. The custom had been to wash items of a similar nature in the same batch, so the linen came from the mangle roughly divided according

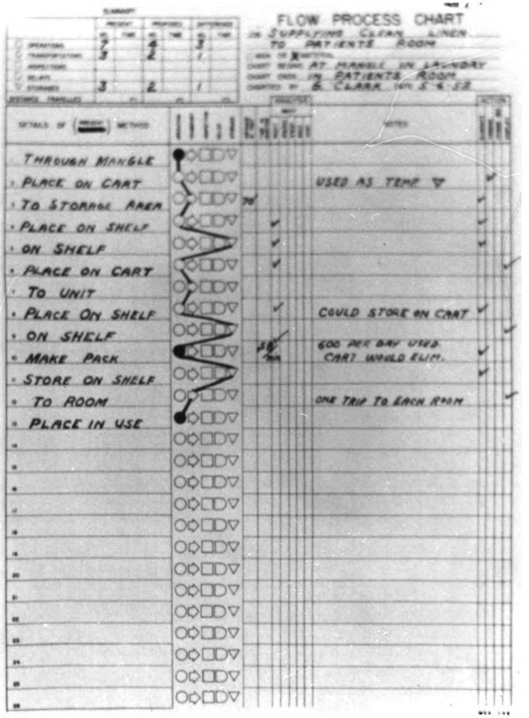


Fig. 5 Flow Process Chart of Present Method of Supplying Clean Linen to Patient's Room

to the type of material. A girl folded it as it came off of the mangle and placed it in a large, shelved cart. When loaded, this cart was pushed to a central storage area in the laundry. This was a distance of 70 feet. Next the cart was unloaded and all of the linen was placed on shelves in the central storage area and kept in storage on these shelves until such time as it was requisitioned by an individual floor. When a requisition was received from a floor, it was filled by taking the proper items from the shelves in the central supply area and placing them on a cart, which a worker would then take back to the ordering unit. When the worker reached the unit with the linen he would place the cart in or near the storage closet and then would transfer the clean linen from the cart and place it on the designated shelves in the storage closet. Linen packs were made up by nurses aids to include all of the linen used for a bed. A typical pack was as follows:

1 spread
1 large sheet
1 draw sheet
1 pillow case
1 face towel
1 wash cloth

1 bath towel

1 gown

The total usage in the hospital was 600 packs similar to this each day. It took .58 minutes per pack to make them up. These packs were stacked on the closet shelf until such time as they were needed to make up a bed. The linen pack would remain in the storage closet until such time as it was needed for use in a patient's room. Then the nurses aid or practical nurse or other person making up a bed would come to the closet, and move the required number of linen packs to the patient's room. Then the linen would be used in the patient's room.

An analysis of this chart shows that there were six operations performed of which only two contributed toward the fulfillment of the task which was providing clean linen in the patient's room. The other four operations merely expedited the fulfillment of this task and therefore, were subject to elimination if it was possible to perform the task without the operations. Operation Two, placing the linen on the cart, was not eliminated. It was combined with the storage problem in the laundry. The carts, which were pushed up next to the mangle so that the linen could be placed directly on to the carts, were used

as the storage facility while the linen remained in the laundry. Operation Four, placing the linen from the cart to the shelves, was eliminated. This also eliminated the need for the storage on shelves in the central laundry. Operation Six, placing the linen on the cart, was not eliminated although it was considerably changed and simplified. Operation Eight, placing the linen on the shelf in the floor closet, was eliminated and the same cart which took the linen to the floor was used as a storage facility. In connection with the elimination and combination of these various operations a saving of one transportation was also effected. However the total transportation distance remains approximately the same. Because the linen carts could be rolled from room to room with a complete supply of all items, the need for making up linen packs was eliminated, and the movement of linen to the rooms was greatly simplified.

It was decided to perform the operation of supplying clean linen to the patients' rooms as follows: (See Figure 6) Starting at the same point as before, that is, when the linen comes from the mangle, it was decided that it would be placed on the same carts as had been used in the old method. However, these carts would be used in an entirely

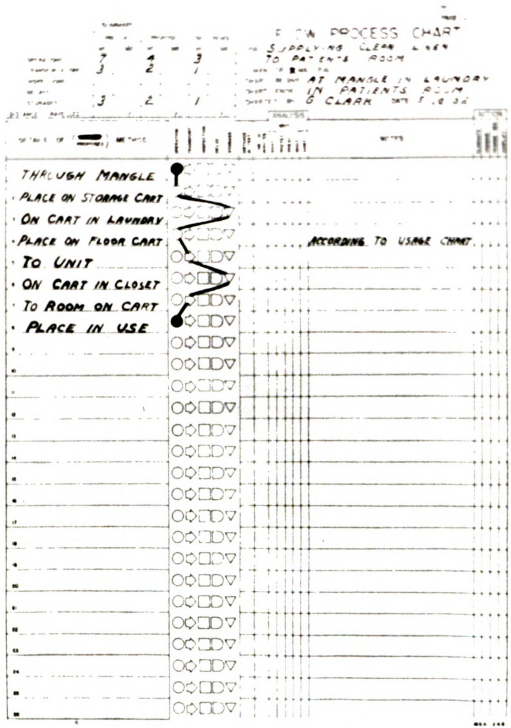


Fig. 6 Flow Process Chart of Proposed Method of Supplying Clean Linen to Patient's Room

different manner (See Figure 7). The carts now would be merely a movable storage bin so that, as the various items came from the mangle, they could be stored and moved sufficiently away from the mangle so that the mangle operators would have room in which to continue working. Next, the linen would be transferred directly from the storage carts in the laundry to a specially designed cart which would go to the floor. This cart was so designed that it would conveniently carry all of the linen needed for a full day's operation in any unit in the hospital. It also was designed so that it could be easily stored in the closet which had formerly been used to store the linen on separate shelves. Enough carts (See Figure 8) were procured so that there would be two carts for each unit in the hospital. One cart would be on the floor, acting as a movable storage unit, and the second cart would be in the laundry, awaiting refill so that it could be transferred to the floor for the next day's operation. Each cart had on it a standard load, which had been determined by studying the past requisitions of each floor and adding a sufficient surplus of each of the various items. This load list was attached to each cart. As the carts were loaded any old linen which had been

Fig. 7 Laundry Cart Being Loaded Directly from the Mangle

Fig. 8 Housekeeping Maid Selecting Linen from a Linen Cart Which is Moved from Room to Room as is needed

returned from the floor from the previous day, was credited to that floor and was placed on the front side of the cart so that it would be used first in the next day's operation. The laundry kept track of the usage of each floor as had been the custom. Each a worker from the laundry took a fully loaded cart to each floor and exchanged it for the depleted cart on the floor. The loaded cart was placed in storage in the closet which had been previously used to store the linen on shelves. Then, when it came time to make up the beds in the unit, the cart would be wheeled down the hall, from room to room, and the linen would be taken from the cart and used in the individual rooms. It also was found that this cart made a very convenient rack on which to carry the dirty linen bags during the period of remaking of the beds and this added convenience was beneficial to the operation.

A cost analysis of the total operation was drawn up (See Figure 9) to show the savings. It can be seen from the cost analysis even though there was a capital expenditure of over $5,000.00 to install this system of handling linen, that through the saving in labor alone this investment was paid off very quickly. The actual period of time that was required to pay off the investment was .84 years. The study

CAPITAL INVESTMENT

42 new carts @ $123.25 ea.	$5176.50	
14 remodeled carts @ $50.00 ea.	700.00	
Total Capital Investment Required		$5876.50

SAVINGS IN LABOR

Deliveries from laundry to floors (4 hrs. per day - 1460 hrs. a year, @ $1.06 per hr.)	$1547.60	
Preparing linen packs (600 packs per day - 35 seconds per pack 5.8 hrs. per day - 2117 hrs. per year, @ $1.07 per hr.)	$2265.19	
Stacking from mangle to shelves (3 hrs. per day - 1095 hrs. per year, @ $1.00 per hr.)	$1095.00	
Total Estimated Savings		$4907.79

DEPRECIATION
(5 years - 20% p.a.) plus 4% for taxes and insurance, 10% for maintenance, and 8% return on investment equals $2468.13 Annual Fixed Charges.

ANNUAL SAVINGS	$4907.79	
ANNUAL FIXED CHARGES	2468.13	
Net Savings		$2439.66 (equals 49.7% on investment)

ANNUAL FIXED CHARGES		
Depreciation (20%)	$1175.30	
Taxes and Insurance (4%)	235.08	
Maintenance (10%)	587.65	
Total	1998.01	
ANNUAL ACTUAL SAVINGS (Gross savings less fixed charges not including interest on investment)		$2909.78 (equals 57.5% on investment)

Fig. 9 Cost Analysis of Use of Linen Cart System

showed that if the cart were to be depreciated over a period of five years, and allowing 4% for taxes and insurance, 10% for maintenance, and 8% for return on investment, that an annual savings of $4,540.87 would be realized for the five year period.

The cost analysis gave the tangible benefits which were realized from the use of the linen cart exchange system. There were other advantages which were of an intangible nature and for which it would be very difficult to determine the actual value of the benefit. Some of these items were:

1. The saving in space which was realized in the central laundry due to not storing the linen on shelves.

2. The saving in space which was realized in the floor closets due to not storing the linen on shelves in this location.

3. The saving in time required to make up beds due to not having to make frequent trips to the linen closet for more linen.

4. The impetus which was given to the entire improvement of patient care program by the hospital-wide display of the results of an accepted project.

A great deal of attention was paid to the problem of getting all personnel at the hospital to properly accept this new system. Many interested parties were consulted before the final plans were drawn up. When it was finally decided what should

be done, two experimental carts were constructed by reworking some carts which were on hand so that they would fit the purpose. These two experimental carts were then used to service a floor according to the plan. After these carts had serviced a floor for a week, they were shifted to another floor and given a week's run in the next location. In this way a great percentage of the personnel became familiar with the use of the linen cart exchange system before they were actually committed to constant use of the new system.

It was found that instead of receiving protests because they were forced to use the system, in most cases the workers protested because the experimental carts were taken away from their floor at the end of the trial period. This reception insured that when the permanent carts were available for use, there would be no great amount of resistance to the rapid implementation of the plan.

G. The Work Sampling Study

In the early phases of the Harper Hospital project there had been alot of work performed to find the duties of the persons directly caring for the patients. This work had been limited to the use of

questionnaire and survey techniques. It was realized that a survey could determine exactly what an individual thought his job was, but some check was needed to determine if the job was being performed as the individual thought it was being performed. It was necessary for a study to be made of activities in the hospitals to determine exactly what the actual picture was as to the care which a patient was receiving.

It would have been possible to obtain such information by the use of long term studies. However, the amount of labor involved would have made the cost prohibitive. It was thought also that the use of the stop watch in the hospital might release a flood of protest, because at this stage in the program the acceptance was not complete; therefore it was decided to try a relatively new industrial engineering tool. This tool was Work Sampling.

The Work Sampling procedure was selected because it was thought that all of the information desired could be obtained in a relatively short time and with a relatively small amount of labor involved. It was thought that the results, while perhaps not as accurate as those which would have been obtained by the use of a long term time study, would be

sufficiently accurate for the purposes for which the information was desired. That was to analyze the functions of the people who were caring for the patients so that the professionals' time could be most profitably utilized. Also, because random observations were used instead of continuous observations, it was possible for one observer to get information about many operations during the same period of time.

Work Sampling is a recent name given by the magazine Factory Management and Maintenance to a process that was formerly known as Ratio-Delay.[10] This technique originally was applied by Professor Robert L. Morrow, of New York University, principally to an examination of machine down-time.[11] However, the technique has been expanded to include almost any set of sample observations designed to simplify or improve productivity. It seems probable that when referring to observations of human activities that the term Ratio-Delay is distasteful. Work Sampling is the name which was used at Harper Hospital for this technique.

Work Sampling is based upon the laws of probability. If a sufficient number of observations are taken at random times, of the same operation, the

results will come surprisingly close to what could be discovered by the use of continuous observation. This is often demonstrated by the throwing of dice or flipping of a coin. If, for example, a coin were tossed one hundred times, the laws of chance favor that it would land fifty times with the head up and fifty times with the tail up. In any sample of one hundred tosses, however, there might be a considerable distortion such as sixty-five heads and thirty-five tails, but clearly the more sets of throws that are made, the closer will be the results to the fifty-fifty standard. Or, the more samples taken, the closer is the accuracy of the average which is obtained as the result.

It should be understood that random observations are exactly what they seem to be. If it is decided that observations are going to be made of a given activity on a random basis for one week, it must then be decided in advance how many such observations will be made in the course of a day. Then, if it is deemed advisable to make ten observations during an eight hour period, those observations should be made at irregular times, and not one every 48 minutes. From an adequate number of observations it can be determined what percentage of time is actually

spent in performing any specific function, what percentage of the total time is taken up by unavoidable delay, and the areas in which it can be expected that improvement can be made. The percentage of interruptions or delays to the total time of the function is what gave the technique its original title of Ratio-Delay.

It stands to reason that the maximum amount of information could be obtained about a particular activity by continuous observation. But continuous observation is expensive and would have required the services of people trained in observation, calculation, and interpretation of the results. Work Sampling has these advantages over continuous observation:

1. It gets the facts at one-third to one-sixth the cost.
2. It does not require observers with special skill and training.
3. It provides the accuracy required.
4. It makes it practical to get facts that otherwise would not be collected.
5. It produces fewer complaints from operators who are being studied.
6. It produces less distortion in the routine of the operator than does continuous observation.[12]

In the study at Harper Hospital it was desired to find out two things. These were, first, what people were actually doing in the unit; and secondly,

how much time it actually took to do those things. That is, what percentage of the time was being spent by professional personnel on a certain job and what percentage of time was being spent by non-professional personnel on the same job.

Because of the complexity of the duties in a nursing unit, it was necessary to set up job classifications. There were in excess of 500 different functions being performed in a typical nursing unit in one day. After considerable discussion with people in the unit and other people involved in the study, these functions were consolidated into twenty-nine classifications with a list of what was to be included under each classification. The personnel was broken down into the following major types: graduate nurse, head nurse, practical nurse, ward clerk, housekeeping maid, student nurse, nurses aid, orderly, and dietary maid. So with this pattern established it was possible, upon the successful completion of the study to determine what percentage of his or her time each of the above types of personnel spent in doing each of the twenty-nine classifications of work.

Three observers were trained to make the actual study. They checked very carefully the twenty-nine

classifications so there would be common understanding as to exactly what work would be placed into each class. Then one observer was assigned to each of the three shifts in the hospital, giving twenty-four hour coverage. It was decided to run the study for seven consecutive days.

A tally sheet was used (See Figure 10) to tabulate the observations as the observer made them. It was decided that each observer would make approximately ten observation tours through the three test units during each shift. These trips would be made at random intervals. At the end of each day, the total observations for that day were placed on an accumulation sheet (See Figure 11) and the percentage of occurrence of each classification was calculated. This calculation was made on a cumulative basis. Some of the more critical items were then plotted on a graph in order to determine if the study was being run for a sufficient length of time to get the desired accuracy. It was known that it was characteristic of a statistical sampling study such as this that the more observations which were accumulated the greater the accuracy. Figure 12 shows the plotting of some of the activities of the head nurse. It was observed that during the first few days of the study these

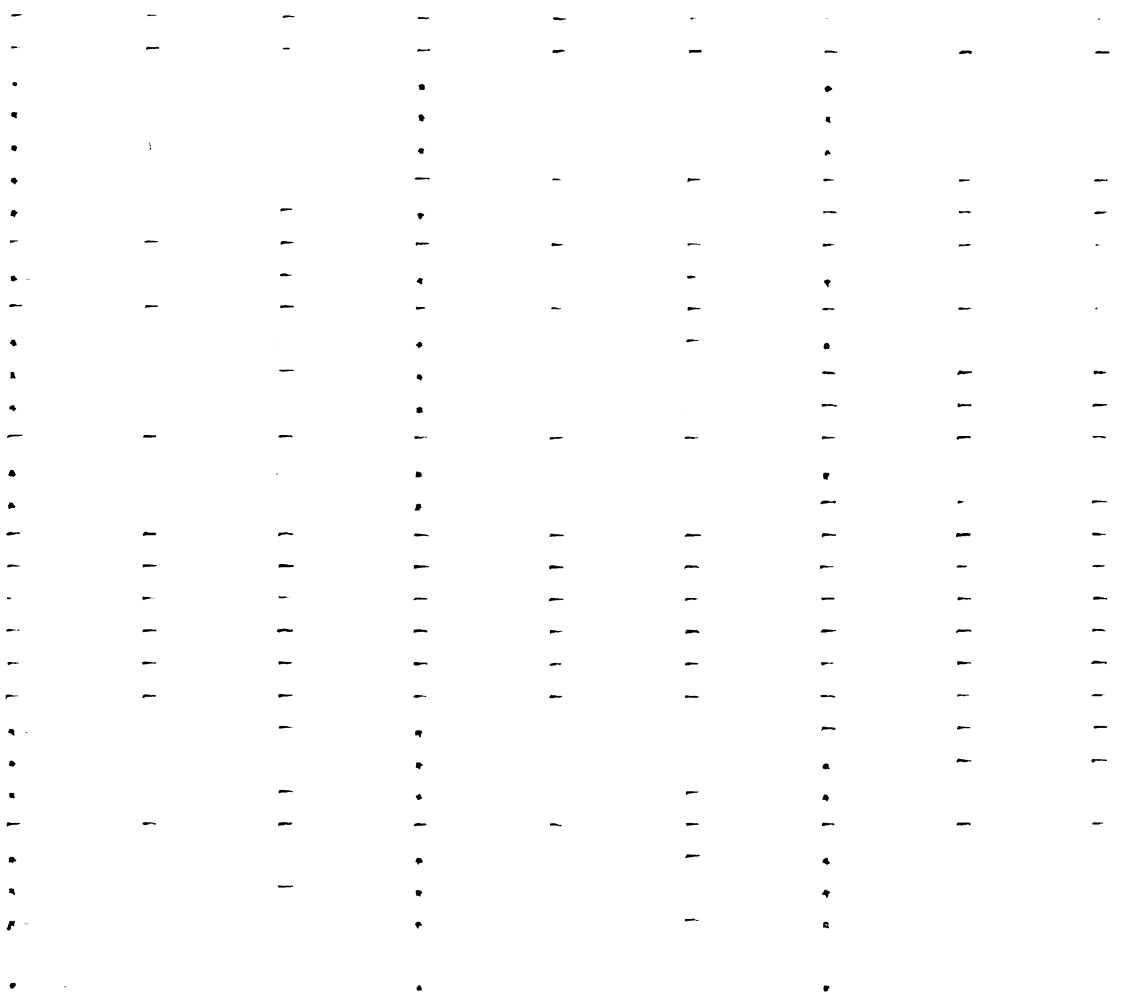
DATE 7-7-51 | FLOOR 2-H | SHIFT 7-3

	REGISTERED NURSE	HEAD NURSE		
1			1	Admitting.
2			2	Answer Lights.
3	11:05		3	Baths and Bedside Care.
4			4	Bed Making.
5	9:45	10:05 1:05 1:40 2:40	5	Charting.
6			6	Clean and Scrub.
7			7	Clerical Work.
8			8	Discharging.
9		8:25 11:05	9	Doctor's Rounds and Assisting.
10			10	Errands.
11			11	Feeding Patients.
12			12	Getting Patient Up.
13		2:10	13	Idle Time.
14			14	Interruptions.
15	8:45 9:15 10:20	12:45	15	Medicines.
16	8:25	7:50	16	Nourishments and Foods.
17			17	Patient Teaching.
18			18	Patient Transportation.
19			19	Personnel Teaching.
20			20	Preparation and Checking Meals
21			21	Reports.
22			22	Student Instruction.
23	11:45	8:45 9:45 10:15	23	Supervising.
24			24	Supply and Equipment Movement.
25			25	Supply Storage.
26			26	Telephones.
27			27	T.P.R.
28			28	Travel.
29		9:15	29	Treatments.

OBSERVATIONS OF THE ACTIVITIES OF REGISTERED NURSES FOR ONE WEEK ON THE DAY SHIFT (7 A.M. - 3 P.M.)

	July 6			July 7			July 8			July 9			July 10			July 11			July 12		
	Daily Total	Total to Date	% to Date	Daily Total	Total to Date	% to Date	Daily Total	Total to Date	% to Date	Daily Total	Total to Date	% to Date	Daily Total	Total to Date	% to Date	Daily Total	Total to Date	% to Date	Daily Total	Total to Date	% to Date
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	2	6.6	2	4	8.0	6	10	14.1	4	14	15.7	6	20	17.7	5	25	19.4	8	33	20.0
4	2	2	6.6	2	4	8.0	2	6	8.5	-	6	6.7	-	6	5.3	2	8	6.2	2	10	6.1
5	5	5	16.6	1	6	12.0	1	7	10.0	2	9	10.1	8	17	15.0	1	18	14.0	5	23	14.0
6	-	-	-	-	-	-	1	1	1.4	-	1	1.1	-	1	0.9	-	1	0.8	2	3	1.8
7	-	-	-	1	1	2.0	-	1	1.4	-	1	1.1	-	1	0.9	-	1	0.8	-	1	0.6
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	1	1	3.3	-	1	2.0	-	1	1.4	1	2	2.2	-	2	1.8	1	3	2.3	-	3	1.8
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	2	2	6.6	-	2	4.0	1	3	4.2	-	3	3.4	-	3	2.7	1	4	3.4	-	4	2.4
12	-	-	-	2	2	4.0	-	2	2.8	-	2	2.2	-	2	1.8	-	2	1.6	1	3	1.8
13	-	-	-	1	1	2.0	1	2	2.8	1	3	3.4	-	3	2.7	1	4	3.4	1	5	3.0
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	7	7	23.3	4	11	22.0	1	12	16.9	7	19	21.3	6	25	22.1	2	27	20.9	15	42	25.5
16	-	-	-	1	1	2.0	1	2	2.8	-	2	2.2	-	2	1.8	1	3	2.3	1	4	2.4
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	1	1	2.0	1	1.4	-	1	1.1	-	1	0.9	-	1	0.8	-	1	0.6	
23	-	-	-	1	1	2.0	6	8.5	1	7	7.8	-	7	6.2	-	7	5.4	-	7	4.2	
24	2	2	6.6	2	4	8.0	2	3	4.2	-	3	3.4	-	3	2.7	-	3	2.3	-	3	1.8
25	3	3	10.0	-	3	6.0	-	-	-	2	2	2.2	1	3	2.7	-	3	2.3	1	4	2.4
26	-	-	-	-	-	-	-	-	-	-	2.	2.2	-	2	1.8	-	2	1.6	-	2	1.2
27	1	1	3.3	-	1	2.0	1	2	2.8	-	4	4.5	-	4	3.5	-	4	3.4	-	4	2.4
28	1	1	3.3	3	4	8.0	-	4	5.6	-	8	9.0	3	11	9.7	2	13	10.0	-	13	7.9
29	4	4	13.3	-	4	8.0	4	8	11.2	-											
TOTAL	30	30	100.5%	20	50	100.0%	21	71	100.0%	18	89	99.6%	24	113	100.2%	16	129	100.9%	36	165	99.9%

Fig. 11 Example of an Accumulation Sheet Used in the Work Sampling Study



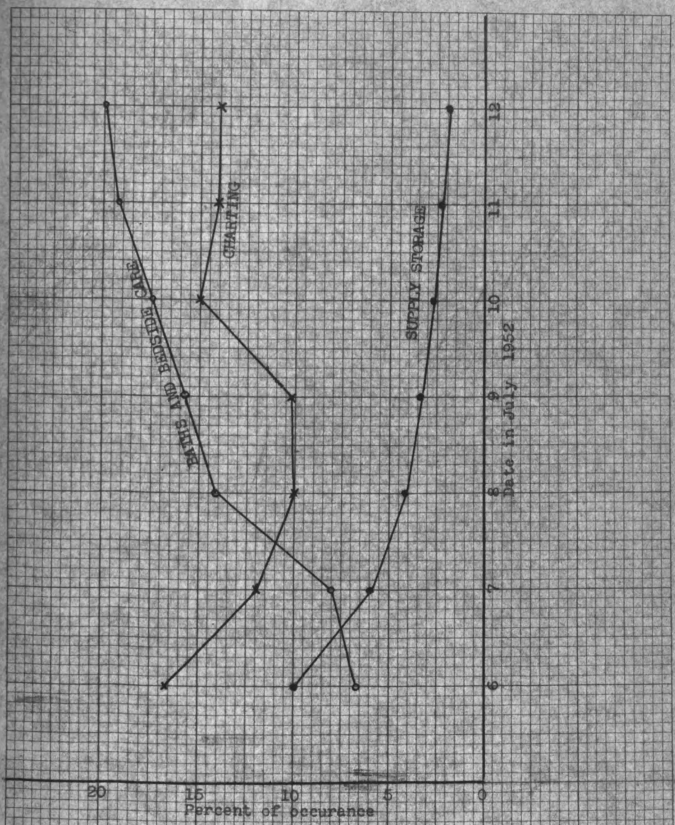


Fig. 12 Determination of Length of Study - Activities of Registered Nurse

activities fluctuated greatly but from the fifth day of the study on to the completion they smoothed out rapidly and it was believed that additional study beyond the seventh day would not be justified, as the information that was accumulated was sufficiently accurate for the purposes desired.

At the completion of the study it was found that a tremendous amount of information had been secured. It was then necessary to analyze this data in order to determine which functions were out of line and how those functions could be realigned in order to make for more efficient operation.

Preliminary to the actual job of analysis, the following charts were plotted using the data which was gathered during the study:

1. Amount of care received by patients.
2. Amount of time and percent of total direct patient care contributed by each type of personnel. (Separate charts were compiled for each shift.)
3. Amount of time and percent of total indirect patient care contributed by each type of personnel. (Separate charts were compiled for each shift.)
4. Percent of personnel time spent on each activity. (Separate charts were compiled for each shift.)
5. Percent of personnel time spent on direct and indirect care of patients by shift.

6. Amount of time in minutes spent by each type of personnel on each type of activity. (Separate charts were compiled for each shift.)

7. Total care in minutes per day given by all types of personnel in each of three test units. (Separate charts were compiled for each shift.)

8. Staffing of units during test week.

9. Comparison of acuity study and percent of time spent by personnel on activities.

10. Questionable activities of professional staff and time involved.

The making of these tables placed the information gathered by the study in groupings and relationships so that it could be analyzed in terms of improving the operations at the hospital.

A committee was formed composed of people familiar with the operations which had been tested, and people skilled in job analysis, in order to study the material which had been assembled. It was the purpose of this committee to interpret the data in order to realign the functions so that the operations could be improved.

The following observations were representative of those made. It was found that the head nurse was giving four per cent of the baths in bedside care and was also giving seven per cent of the medications on the 7:00 to 3:00 shift. Although neither of these

duties were considered head nurse functions. The head nurse also was giving 36.2% of the treatments; again this was not a head nurse function. It was found that the head nurse was spending 17% of her day in charting and yet she was spending only 32% of her time on truly supervisory functions. She was spending 15% of her time giving medications, 3% of her time giving treatments, and 1% of her time in clerical work. It was immediately asked, are bed making, charting, clerical work, medicine and treatments proper head nurse functions, and shouldn't she be spending more than 32% of her time supervising.

In the field of the graduate nurse it was found the average graduate nurse spent 65.9% of her time giving direct bedside care on the 7:00 to 3:00 shift; 48% of her time on the 3:00 to 11:00 shift, but only 30.8% of her time on the 11:00 to 7:00 shift. As one of the purposes of the entire program was to determine the best utilization of professional skills, the question was raised as to why a graduate nurse was spending only 30.8% of her time on the 11:00 to 7:00 shift doing direct bedside care. Couldn't she be spread over a wider range of patients if some of the functions which she had been performing were allocated to other persons? For instance, she was

doing 85.3% of all the clerical work on the 11:00 to 7:00 shift, 49.7% of the supply storage, and 37% of all the supply equipment movement on this same shift. This work should not have been done by a professional person. These questionable activities of the professional staff are shown in Figure 13.

Another activity which was considered was that of idle time and interruptions. For example, on the 11:00 to 7:00 shift the idle time was as follows: 4.7% for the graduate nurses, 11.6% by the practical nurses, 34.5% for the aids, 31% for the orderlies. This indicated that the less training the individual had, the more supervision was necessary in order that a proper job be performed. This was added evidence that the head nurse should have been spending more than 32% of her time in a supervisory capacity. A far greater amount of available time was lost by idle time in other classes of work due to the lack of supervision, than could possibly have been gained by the performance of duties by the head nurse.

As a result of the analysis that was made, a staffing pattern was planned for the test unit based on all of the information which had been collected so far. This included not only the information which

HEAD NURSE	Time in minutes		
	7-3 shift	3-11 shift	11-7 shift
Bedside care	26.4	none on duty	none on duty
Bed making	9.6		
Charting	84.0		
Medicines	98.0		
Treatments	16.8		
Total	234.8		

GRADUATE NURSE or STUDENT NURSE (acting as replacement)			
Bed making	28.8		
Charting	61.3*	75.6*	94.8*
Clean and scrub	8.8	1.4	18.3
Feeding	10.8		
Nourishments	10.8		
Supply movement	19.8	7.2	
Supply storage	8.8		
Clerical work		55.8	119.4
T.P.R.		12.0	
Total	149.1	152.0	262.5

* excessive

Fig. 13 Questionable Activities of Professional Staff

had been collected by the Work Sampling study but also that which had been obtained by using the questionnaires, and the changes in functions which had been accomplished by some of the central services which had been set up.

In this new staffing pattern the amount of treatment which each type of patient needed, was determined and professional help, aid help, practical nurse help, and clerical help were assigned to the wards in the proper proportions so that each person could do the task which he or she was best qualified to do. A head nurse was placed in charge of two units and she was able to supervise the care of from forty to forty-six patients on the theory that the graduate nurse was a charge nurse responsible for the direct supervision of personnel working with her. Patients were assigned directly to a graduate nurse. She delegated the duties and planned for the nursing care of the assigned patients. The function of the head nurse was that of ward manager, coordinator, and teacher.

A training program was established to teach all of the personnel selected for the test unit, the new staffing pattern and the duties which went with each job.

The plan was put into operation and after it had been operating for approximately four months the unit was re-surveyed in order to determine the effectiveness of the plan. A second Work Sampling study was conducted and it was found that the plan was actually operating very nearly as it was intended it should operate. A great deal of credit for the proper carrying through of the plan was given to the training which was provided for all personnel as to the duties they would be expected to perform under the new staffing pattern.

The patients were surveyed regarding their satisfaction with the care provided under the new staffing pattern. There were eleven items in the survey relating to nursing care, and when the new survey was compared with the survey which had been made under the old staffing plan, it was found that there was increased satisfaction on seven items in the survey. Three items remained about the same. On only one item was there a drop and this was only 2.5%.

In addition the personnel actually using the new staffing pattern were surveyed regarding their satisfaction with the pattern, and their comments were in the main complimentary to the new staffing pattern.

CHAPTER V

CONCLUSIONS

A. Restatement of Problems

In the beginning of the study, two main problems which were faced, for which it was hoped there would be a solution, as the result of this study.

These problems were:

1. To get maximum utilization of professional personnel.
2. To reduce, or prevent further increases in operating costs.

The following conclusions will indicate how well these objectives were met.

B. Utilization of Professional Personnel

There are two indications of a solution to the problem of utilization of professional personnel. These are: First, as a result of the realignment of functions which took place in the test units, it is possible to use less professional personnel to cover those units. This program, which was proved in the test, was put into effect throughout the entire hospital. As a result of the implementation of this

plan, Harper Hospital has been able to open more beds than at any time in its history. The professional personnel on the payroll, even with this increased number of beds for patients, has been materially reduced. Interested parties can obtain the exact amount by contacting the author or by corresponding directly with Harper Hospital.

There are other indications of the savings of professional personnel which were of a nature which made them extremely hard to measure directly. These savings were manifested by an interest on the part of professional people throughout the hospital in the application of the principles of industrial engineering to their particular jobs. In many cases there was no change in the staffing pattern but it is believed that, as a result of minor changes which took place because of the questioning attitude on the part of these people, the persons in question were able to better perform their jobs.

C. Reduction in Operating Cost

It is concluded that the objective of reducing operating cost was accomplished. However, it had been decided early in the study that the reduction in cost would not be publicized as a major achievement.

This was done for two reasons. First, it was felt that there might be a reaction on the part of the patients if they thought they were getting "cheapened" care. It was decided that the emphasis would be placed on giving the patient better care and not on the reduction of cost to the patient. Secondly, it is thought that there might have been unfavorable reaction among the employees of the hospital if these savings were publicized.

There were several studies made which could be directly analyzed in terms of reduction in cost. The one chosen, as representative, for inclusion in this report was the use of the linen exchange carts. This improvement resulted in an annual savings in direct labor of $4,907.79 and a net savings after deducting for fixed costs of $2,439.66. This represented an annual return of 57.7% return on the $5,876.50 invested.

There are savings in operating cost which were not directly analyzed in terms of dollar savings. One manifestation of these savings is the fact that after the nursing group had taken the work simplification classes and had been exposed to the study for some time, on their own initiative, they revised fifteen of the nursing procedures in light of the

principles of motion economy. It is their intention to continue this project until all nursing procedures had been completely checked.

Another similar manifestation is the work performed by the people in the pharmacy in the prepackaging of drugs in order to get a more efficient operation.

D. Employee Morale

As a result of this project there is a distinct change of attitude among the employees at Harper Hospital. Because of the realignment of functions in the nursing units, there is a feeling that there has been a rise in the status of the professional nurse. The so-called "menial" tasks have been removed from her sphere of responsibility and she is able to concentrate on the professional tasks for which she has been trained.

As a result of taking many tasks away from the professional and giving them to lower classfications, the status of these jobs also has been raised. This is evidenced by the attitude of the housekeeping maids. They are given the entire responsibility for preparing rooms to take a new patient after the check-out of the previous patient. This

includes the responsibility of notifying the admitting office when the room was ready for occupancy. Previously, a professional had to check the room, and the maids had considered this a slighting of their ability.

E. Better Care for Patients

As a result of the transfer of many non-professional tasks to workers other than the professionals, the professionals are able to spend more time actually caring for patients. This is true even though the professionals have been given more patients to care for. The Work Sampling study which was made after the new staffing plan had been put into effect, shows this added care to the patients is an actual fact.

Also, the survey of the patients themselves definitely shows that they are better satisfied with the care they received under the new staffing pattern than they had been with the care which they had received previous to that time.

F. Areas for Future Study

It is felt at the conclusion of this study, that the original objectives have been satisfactorily accomplished. However, it is also felt that the

project itself is not completed, but is actually only beginning. It is thought that the following areas could have been explored profitably.

In spite of the fact that there was an accomplishment of the original objectives, it is realized that several improvements could be made in the areas which were studied. This would include refinement of the techniques which were used, and a continuation of the Work Simplification Training program until such time as all responsible parties in the hospital had received this training.

It is thought that time standards could have been applied to the hospital situation. This was discussed during the original project but it was decided that it was not the opportune time to install time standards when the study was just beginning. But it is thought that time standards should be installed at some future date. Such installation would provide a means of measuring changes in methods and would insure control of methods which had been installed.

It is thought that there is a large amount of work to be done in the field of paper work simplification. This matter was not approached during the original study because of the lack of personnel to do the large job which would have resulted.

In the original study the operating rooms and the medical staffs were not included except at such times when their work and the work being performed in the nursing units coincided. However, it is felt that in the future the techniques which were applied elsewhere in the hospital can be equally well adapted to those areas.

Due to a desire to stay away from radical changes, in order to get acceptance, and also due to a lack of knowledge of basic processes, the study as it was performed did not challenge any of the basic medical processes. However, it is felt that if persons with a good medical background, were properly trained in the industrial engineering techniques, many of these processes could be challenged and altered in order to obtain more efficient operation, without in any way impairing the care which the patient would receive.

It was and is the earnest resolve of all persons connected with the project for the improvement of patient care at Harper Hospital, that the application of the principles of industrial engineering to a hospital situation, could be promulgated throughout the entire country. There are evidences that this will take place in the near future.

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