A STUDY TO DETERMINE THE MOST EFFECTIVE SYSTEM OF MATERIALS DISTRIBUTION FOR METHODIST HOSPITAL, LUBBOCK, TEXAS

A Problem Solving Thesis

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By

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CHAPTER I

INTRODUCTION

Materials distribution in today's multistoried hospitals present problems which are not new to the delivery of health care. Materials large or small, disposable or reusable, sterile or dirty, must move both horizontally and vertically throughout the hospital.

The patient is the recipient of all supplies and materials either directly or indirectly. The function of materials distribution is to place the supplies and materials in the right place at the right time to meet the patient's needs.

There are several systems available to the hospital, some of which may satisfactorily serve its needs. The use of automation for materials distribution is becoming more widespread as initial costs of installation are reduced. Semiautomated systems such as dumbwaiters and pneumatic tube systems, are also available. The manual cart-exchange is the basis for most of the automated systems which are frequently found in today's hospitals. The aforementioned systems may be utilized individually or by combining them into a unique system to fit a particular need.

Rarely will any two hospitals present identical materials distribution needs. "The materials transportation

system for any hospital should reflect the hospital's needs and architectural peculiarities."[1] The correct materials distribution system can relieve many complex problems in the hospital. It is the responsibility of the hospital's management and central service to search continuously for more effective and efficient methods to meet the needs of the patient.

Materials distribution systems can be used to increase the productivity of the professional and nonprofessional staff. Many hospitals have established a central supply center from which all supplies are dispatched. Others utilize a decentralized materials distribution system. Responsibilities may be decentralized into separate departments such as central supply, pharmacy, laundry and linen, and dietary. There are several advantages to decentralization.

> It brings managers closer to the objectives of the business. It permits tighter control of costs. It provides a better environment for training future managers. It helps stimulate improvements in products and methods.[2]

The important point is not centralization or decentralization; rather, that the patient care staff is completely relieved of the supply responsibility.

Charles E. Housley points out that one of the objectives of a materials distribution system is: "To relieve the nursing service of the nonnursing functions of inventory, requisition, recording, delivery, and processing

of supplies."[3] This can be accomplished by the use of either automated or manual cart-exchange systems. These systems will be discussed in detail later. Either system is particularly effective when used in combination with semiautomated systems previously mentioned.

The essential purpose and use of these systems are to increase staff effectiveness and efficiency, to reduce congestion in public corridors, to be cost effective, and to serve the needs of the staff and the patient.

This paper is a study made to solve the problem of materials distribution for Methodist Hospital, Lubbock, Texas.

Hospital History and Setting

Methodist Hospital opened its doors on January 1, 1918; as Lubbock Sanitorium, a twenty-five patient bed facility located at 1300 Broadway, Lubbock, Texas.

In 1942, the name was changed to Lubbock General Hospital, and in 1945 it became Lubbock Memorial Hospital. At that time, management of the hospital was conducted through a Memorial Foundation created by Doctors J. T. Krueger, M. C. Overton, and J. T. Hutchinson.

The present West Building (Appendix A, Enclosure 1) was opened with 203 beds in 1953 when the hospital moved to its present location on West 19th Street. The nursing school which had joined Lubbock Sanitorium in 1918 moved

with the hospital. In April, 1954, the name was changed to Methodist Hospital and School of Nursing and the Northwest Texas Conference of the United Methodist Church assumed ownership and operation.

Since 1959, Methodist Hospital has been remodeled and expanded many times, increasing the number of patient beds each time. In June, 1959, the School of Nursing moved into a new wing of the hospital, and a dormitory for student nurses was completed in 1960. The entire school was moved into a new building at 2001 Miami Avenue in 1970.

Groundbreaking ceremonies for the new East Building were held on January 26, 1972. This new building with 195 patient beds was occupied in August, 1974. The West Building is currently being modernized, with completion scheduled for early 1976. The total patient beds at Methodist Hospital will be 549 at that time.

The hospital's physical plant consists of an eight-floor West Building, a three-floor Central Building, and a nine-floor East Building. These floors are arranged in a "T" shape. There are no clinics located within the hospital nor commercial outlets. The hospital does operate an emergency room service.

In 1972, Texas Tech University opened its medical school. Methodist Hospital became a teaching hospital associated with this school. Currently, there are on the

average, twenty medical students at Methodist Hospital. The number is expected to increase as the student body at the Medical School increases. The average student body per class of nurses is fifty.

The hospital staff includes 204 physicians, 17 dentists, 140 registered nurses, 129 licensed vocational nurses, and 94 nurses assistants. The total staff is 1,105 employees.

Methodist Hospital is the largest hospital in the South Plains area of Texas serving a rural and urban patient population from West Texas and Eastern New Mexico. The hospital is dedicated to providing the finest health care available anywhere.

Conditions Which Prompted the Study

Methodist Hospital completed construction and occupied the new East Wing of its present plant in August of 1974. The West Wing is currently partially closed for modernization. There are three different systems of materials distribution in use at the hospital. There was a need to expand a distribution system into the currently closed areas of the West Wing. There was a definite need for an effective system of materials distribution. The desire of management was to reduce the time necessary to resupply the using services and to reduce cost. Data was needed by the hospital management to

provide the necessary information upon which it could base its decision concerning the appropriate distribution system for materials and supplies eminating from central supply.

Statement of the Problem

The problem was to determine the most effective system for materials distribution at Methodist Hospital, Lubbock, Texas.

Definitions

Automatic Distribution System.--A self-propelled, totally automatic system capable of handling 90 per cent of the supplies and materials in the hospital. The system requires assistance for dispatching only.

Dumbwaiter.--A small elevator of special design to transport either supplies and materials or supply carts vertically in the hospital.

Manual Cart Exchange System.--A materials distribution system which utilizes carts that are manually exchanged at the using service on an established schedule.

Pneumatic Tube System.--A system of tubes throughout the hospital designed to transport small items and administrative paper work, or designed to remove soiled linen, laundry and trash.

Semiautomatic Materials Distribution System.--A system designed to transport a portion of the hospital's total

needs for supplies and materials. Examples of semiautomatic systems are conveyors, dumbwaiters, and pneumatic tube systems.

Traditional Distribution System.--A system characterized by large supply closets at the site of the using service and by full involvement of the professional staff in the inventory and resupply process.

Factors Bearing on the Problem

The following management policies and plant characteristics had a bearing on the problem:

1. Methodist Hospital is currently using a manual cart-exchange system, a traditional ward supply system, and a cart-resupply system for materials distribution.

2. Central supply delivers supplies and materials directly to the users.

3. The hospital is constructed in a "T" shape with elevators located in each of the two towers which have eight and nine floors, respectively.

4. There is a pneumatic tube system and a dumbwaiter system in both towers.

Assumptions

The following assumptions have a bearing on this study:

1. There will be an increase in the inpatient workload.

2. There will be an increase in the central supply workload.

3. Management's policy will continue to be decentralized distribution of dietary, pharmacy, laundry, and linen.

Objectives

The following objectives have been established to assist in this study:

1. Determine the volume of supplies and materials which originate in the central supply center.

2. Evaluate the advantages and disadvantages of each system in use at Methodist Hospital in relation to its unique physical characteristics.

3. Evaluate the advantages and disadvantages of the appropriate distribution systems recommended in current literature.

4. Determine the number of carriers necessary to effectively distribute supplies and materials.

5. Determine the number of employees necessary to man the expanded needs of materials distribution.

Criteria

Any system of materials distribution at Methodist Hospital must be selected in accordance with the following criteria:

1. The system must provide the needed supplies and materials to the using service in a volume adequate for twenty-four-hour patient care.

2. The system must provide a mechanism for proper inventory control.

3. The system must provide a mechanism for control of both patient charge items and nonpatient charge items.

4. The system must be a central supply function, which requires no direct involvement of the professional staff of the using service.

Research Methodology

The research methodology for this study consisted of the following:

1. A review of the related literature was made to gain a thorough understanding of materials distribution systems which might be applicable at Methodist Hospital.

2. Observation of current distribution systems in effect at Methodist Hospital were made to determine their effectiveness.

3. Unstructured interviews were conducted with administrators, managers, central supply technicians, and

nurses to determine their views of the current distribution system.

4. Administrative procedures were observed to determine their effectiveness. Forms used in the procedures were studied to determine if existing forms were adequate or if others were necessary.

5. Interviews were conducted with individuals knowledgeable in materials management.

6. Data on the volume and flow of supplies and materials from central supply to the users were compiled through a review of requisitions maintained by this activity.

7. Observation of the distribution system currently operational at the Audie Murphy Veterans Administration Hospital, San Antonio, Texas was made.

Review of the Literature

Traditional system

A review of the current literature revealed that there are various basic systems of materials distribution used in hospitals today. The traditional system does involve the professional staff of the using service. Large supply closets are required to hold the inventory of necessary items. It is not unusual to find a thirty-day stock level maintained by each using service. This stock must be inventoried and the reorder administrative procedure performed by personnel of the individual services.

Often, this is not done until stock levels are low or until a need arises. "This results in poor inventory control and increased costs through inefficient utilization of nursing unit personnel."[4] This reorder procedure could lead to unnecessary delays because an item is not available. If this occurs, time is wasted, and medical procedures delayed until supplies can be obtained.

Historically, the traditional system has required the use of huge inventories found in supply closets throughout the hospital. This large total inventory is very costly to the hospital. Further, the literature reveals that where large inventories exist, theft and misuse are correspondingly high. Finally, it is difficult to control patient charge items in such a system. This results in huge financial losses to the hospital. In the traditional system, items are not properly labeled nor are they correctly charged to the patient when used.[5] The loss of patient charge items is not necessarily unique to this system. It could occur in any system if proper controls are not maintained. Item identification and user accountability on a timely basis can eliminate most losses.

Most of the hospitals do not give much consideration to traditional systems which require the ward's staff involvement and require excessive stock levels on the wards. "Experience and observation indicated that in

traditional systems, nurses spend an inordinate amount of time on jobs that might be performed by others."[6] Most hospitals have as an objective of the materials distribution system that it be totally a materials management function. The Cardinal Cushing General Hospital in Brockton, Massachusetts, after observation of such a system, states, "Our objective was to develop a plan for supportive services that would free nurses for greater clinical involvement in direct patient care."[7]

Manual cart-exchange systems

In the manual cart-exchange system, carts are assigned to each using service to replace the traditional supply closet. A cart is placed in the using area, and another cart with identical inventory is kept in central supply to be exchanged on some established time schedule. The exchange is done manually on the predetermined schedule. The system is effective for bulk supplies, laundry and linen, and pharmacy items. In the case of linens, the exchange cart system can reduce the number of steps involved from seven to three. The seven step traditional system is as follows:

1. Remove linen from folding table onto cart.
2. From cart onto linen room shelves.
3. Linen room shelves onto cart.
4. Take cart to floor.
5. Unload cart and place in floor linen cupboard.

6. Count and load onto cart.

7. Distribute to patient's room.

The exchange cart alternative involves only three steps and can be used for central supply items. The three steps are as follows:

1. Load linen onto carts.

2. Take cart to floor storage area; carts serve as linen storage, and new carts are delivered once every twenty-four hours.

3. Use carts to deliver linen to patient's room.[8]

St. Anthony Hospital, Columbus, Ohio, has developed a cart exchange system. Several objectives were established for the system. The hospital began by establishing an objective to provide the using services with a total supply system, encompassing both charge and noncharge items, whereby the right supply would be at the right place at the right time. This was followed by an objective to relieve the nursing service of nonnursing functions. Nonnursing materiel functions include those of inventory, requisition, recording, delivery, and processing of supplies. Another objective was to effect a practical system of control of "unofficial" inventory items already charged to the using services. There was a desire to implement an effective and efficient method of controlling patient charge items. The final objective was to place full responsibility in the materials management department

for the functions of supply, processing, and distribution. These objectives were accomplished by the following:

1. An established cycle of distribution of supply carts.

2. A functional patient-charge mechanism.

3. Assembly line cart processing accomplished by supply.[9]

There is usually an initial distrust in the cart-exchange system by the nursing staff. When a large volume of inventory is replaced by one or two carts, nurses are skeptical and feel that the inventory will not be sufficient. The nursing staff can be reassured by the fact that adequate supplies are available in central supply and that communications are available to obtain them. Further, the staff can be reassured by the fact that the carts will be exchanged automatically and routinely by central supply. The materials management department must inform the staff of their ability to provide these services. It has been found that the initial distrust for the system dissolves as the nursing staff becomes familiar with the new operation.[10]

The effective operation of the cart-exchange system provides inventory control with particular interest placed in the control of patient charge items. Included as a part of each cart is a list of its total inventory.

> Both chargeable and nonchargeable items are included on the cart. Usage of both types of supplies is controlled and reported by the use of charge tickets and inventory control record sheets. The forms are kept on the cart.[11]

Supply technicians are responsible for the labeling of each item with a card printed by computer, if possible. The user of the item simply identifies the patient to whom it was given and returns the charge card to the receptacle provided on the cart. Supply technicians compare the cards to the remaining inventory upon completion of each exchange cycle. Thus, control is direct and immediate. Items unaccounted for can be immediately corrected by the staff from memory or from a simple search of the patient's records. Experience has shown that a large financial savings can result from this procedure. Charles Housley, Associate Administrator at St. Anthony Hospital, states that "Prior to the new supply system, there was a total monthly loss of $1,000 or more because of unrecorded use of patient-charge items."[12] This system of checks and balances virtually eliminated the unrecorded use of patient charge items.

The literature indicates that the advantages of the manual cart exchange system are:

1. Flexibility.
2. Simple maintenance.
3. Low initial capital costs.
4. Improved control of inventory.

5. Return of nursing staff to direct patient care.

6. Standardization of the inventory and its location both in the area of the using service and its location on the cart.[13]

The literature also indicates two disadvantages found in the manual cart-exchange system. Since the system is manual, its operation requires an increased number of employees. It should be noted that these are generally low-salaried employees, therefore reduced emphasis should be given to this disadvantage. The second disadvantage is that the risk of contamination is increased when supplies are transported through public corridors.[14]

Semiautomated systems

There are three basic systems which are considered in this area. They are: (1) self-propelled carriers, (2) conveyors, and (3) pneumatic systems. Each system will be discussed separately, with advantages and disadvantages considered collectively. The literature suggests that they have enough in common to be considered collectively.

The self-propelled carrier system has four basic components: tracks, switches, cars, and a power source. The self-propelled electric cars travel along tracks which may be mounted on walls, ceilings, or floors. The key to this system is built-in controls which can be set to predetermine the desired destination of each car.

Cars are available in two sizes capable of carrying ten or twenty pounds. The system is not capable of transporting large bulk items. It is designed for the many nonbulk items necessary throughout the hospital.[15]

The second system considered semiautomatic is the conveyor system. "Next to the pneumatic tube system, the selective vertical type conveyor is the most common system to be found in hospitals."[16] A conveyor system is an endless chain or belt-driven conveyor capable of reaching all areas of the hospital. It is basically a vertical system, but it can be both vertical and horizontal. For this to be accomplished, many components must be added to the basic vertical system. These additions become very complicated and expensive. Some examples of costs are: a 90 degree turn, from $700 to $1,500; a one-story, selective conveyor, $10,000; a special runoff from ceiling to floor, $6,750.[17] Costs and mechanical problems escalate with each horizontal component added to the system.

The conveyor system may be equipped with any of three carrier tubs. Each is capable of carrying a forty pound load and is constructed of fiberglass. The cars are autoclavable and sanitizable. The basic sizes are: (1) 16" by 11-5/8" by 9-13/16" deep, (2) 17" by 20-1/2" by 10" deep, and (3) 20" by 16" by 4-1/2" deep. The size of the carrier tubs again point out the fact that the system is not designed for transportation of bulk supplies.[18]

A tray conveyor may be commonly used by food service. This conveyor is normally vertical only and is manually loaded and unloaded. Automatic tray conveyors are available but are not generally accepted. If they are not precisely timed, dumped trays will be the result. The tray conveyor varies from the vertical conveyor in that it has shelves to accept trays rather than carrier tubs.[19]

A final conveyor system to be discussed is commonly found in the warehouse of the hospital. The horizontal gravity conveyor may be found in two basic types: skate wheel conveyors and roller conveyors. These are operated by force of gravity. These conveyors are only a small segment of a total materials distribution system. They are found in run-off areas of powered conveyors and in the receiving area of the warehouse.[20]

The third system to be discussed under the general heading of semiautomated is the pneumatic tube system. The Klinikum Hospital complex in Berlin, Germany, uses an intricate network of pneumatic tubes to deliver small items. "A fully automatic pneumatic tube system will carry medicine, plasma, syringes, and small instruments to 124 stations throughout the Klinikum."[21] Pneumatic tube systems are of particular importance in the transport of administrative paperwork in support of a manual or automatic distribution system. Carriers from sixteen to

thirty inches long are used for soiled linen or trash movement.

There are two methods used to control the destination of the carriers in pneumatic systems. "The various tube systems can be either carrier- or station-controlled."[22] The carrier-controlled system uses carriers which have the designation on them and signal the selecting components in the system by direct contact. Station-controlled systems deliver uncoded carriers from a dispatch area to the using services. Some hospitals today use computerized control of the pneumatic tube system. The results are higher rates of downtime and higher initial costs, therefore no appreciable improvement in service.[23]

The main advantage claimed by all semiautomatic handling systems is reduced labor costs. W. J. Baker of the National Association Hospital Central Service Personnel clearly identifies the circumstances which make this advantage possible.

> Logically, near-total automation cannot be the answer to cost reduction in all instances, nor in most cases; but also logically, conveyorized movement of supplies with centralized programming will be applicable to the larger institutions where material handling represents the larger volume of traffic.[24]

Each system has advantages. The self-propelled car is flexible because it can be added to available space and can be expanded by adding track. The large pneumatic tube systems have low operational and maintenance costs. The

small pneumatic tube systems are easy to operate and are relatively quiet.

The main disadvantage of most semiautomated systems is their high initial cost as compared to manual systems. As the systems become more complicated and more automated, the maintenance requirements increase correspondingly. The self-propelled car may require special cushions to prevent spillage or damage to contents. Large pneumatic tubes are noisy and require training of employees to prevent blockages. The smaller pneumatic tubes have a history of malfunctions and high maintenance costs. Most semiautomated systems have limited flexibility. When permanent elevators, shafts, tube systems, or conveyors are installed, flexibility is lost.[25]

Automated systems

Automated distributions systems are self-propelled, totally automated, and capable of handling approximately 90 per cent of the supplies and materials used in the hospital. The systems require manual assistance for dispatching only. Three basic systems were described in the literature. They are the monorail system, the automatic cart system, and the automatic cart transported by monorail.[26]

Mercy Hospital, Buffalo, New York, installed a chain drive, monorail-type, automated cart-transportation system.

> The principle function of the monorail is to move supplies to departments and nursing units on the floors above the S.P.D. (Supply, Processing, and Distribution) with a minimum of personnel and in the shortest time possible.[27]

The system is basically the exchange cart system transported throughout the hospital by a chain-drive monorail. Throughout the system, a single rail hanging from the ceiling provides the power and the path. Carts are attached to frames hanging from the rail. While in motion, the carts hang several inches above the floor and touch the floor only at designated points where they may be removed or attached to the system. The total system is composed of elevators, power monorail, free monorail, and push carts.

> Many materials handling engineers believe that a power and free monorail system is undesirable in a hospital, as it is a potential source of traffic jams and accidental mishaps.[28]

The design of elevated carts not touching the floor provides the advantage of reduced cross-contamination throughout the hospital. Cross-contamination is further controlled by the use of separate clean and dirty distribution routes. The main advantage of the automated cart-transportation system was reduced labor costs.

There were several disadvantages listed in the literature. The system requires high initial costs and is inflexible because each system requires a series of tracks and elevator shafts. Another disadvantage was that the

system requires skilled maintenance personnel available on short notice. The system was susceptible to complete shut down should either the monorail or elevators fail. Therefore, a backup system must be available to move supplies and materials throughout the hospital.[29]

The second automated system which was discussed in the literature is the self-propelled monorail system. Cyberail, manufactured by Sybron Corporation, is an example. This system requires a vast network of rails, switches, and a special floor for "round-house switching." It uses a container whose dimensions are 41" high by 34-1/2" wide and 22-1/2" deep. Each container can accommodate a maximum load of 220 pounds. Two full-length doors provide easy access to the contents of the container. The transporter is the primary moving device of the system. It has an automatic leveling device that insures that the containers are always in an upright position. The system is totally automated and is controlled by a selector panel at each station which has both sending and receiving capabilities.[30]

The costs of the system are not available and vary with each installation. James P. Swindler, director of materials management at Methodist Evangelical Hospital, Louisville, Kentucky, provides some insight to the costs of the system:

> The technique is to offer the prospective client a computerized simulation and study of his traffic patterns--at a cost usually starting at

> $30,000. In at least four cases, this system has cost approximately 10% of the total cost of the hospital.[31]

The other disadvantages and advantages of this automated system were previously stated in the review of the automated cart-transportation system.

The third automatic system is composed of unmanned carts equipped with rechargeable batteries, which are guided electronically by low-voltage wires embedded in the floors of corridors and elevators. The system requires no special shafts to house the transporting equipment. It does require a special elevator or elevators which will respond to the automated system. The carts will automatically distribute supplies and materials and can be used to return soiled materials.

The carts are equipped with stainless steel modules which completely enclose the contents, eliminating the possibility of cross-contamination. Upon completion of a distribution cycle, the cart propels itself automatically through a washer-sterilizer. Each module has a capacity of up to thirty-two cubic feet, or 1,000 pounds. The carts have the capability of being moved manually, but due to the weight of each unit, it is unlikely to be used to any great extent in this manner.[32]

The advantage of reduced labor cost and the disadvantage of high initial cost have been mentioned under the discussion of the automatic cart-transportation system.

The other advantages and disadvantages previously discussed are also true of this system.

The decision of which system to elect will continue to be made as new hospitals are constructed and old ones are modernized. Considering the fully automated system, "one might generalize that, from an economic standpoint, it is difficult to see how these systems will justify themselves for this hospital at this point in time."[33] Several factors should be considered before a selection is made. The physical characteristics of the building must be considered. It may determine what systems can or cannot be used. Labor costs must be considered because manual systems require more low-cost employees, while automated systems require fewer high-cost employees. Expandability and flexibility must be considered if future needs are to be met. Finally, conveniences to the patient and staff must be considered. Some of the semiautomated systems are difficult to cost justify by themselves, but add convenience when added to other systems.

The one theme found throughout the literature is that hospitals must plan to fit the unique needs of their physical plant and hospital objectives when selecting a materials distribution system.

> Each hospital construction project, because of the hospital's objectives, site location, and projected growth pattern, offers a unique problem in planning for materials distribution.[34]

> In planning a cart exchange program, the method of distribution of the carts should be determined early, because if the decision is to use automated distribution systems, the architectural design of the building will be effected.[35]
>
> One thing is clear: hospitals faced with questions regarding these alternatives previously discussed should take the time to analyze their particular situation. If this is done, the decision can only lead to better management and a more efficiently operating hospital.[36]

Chapter II will provide some of the unique characteristics of Methodist Hospital as they relate to the selection of a materials distribution system.

Footnotes

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[3]Charles E. Housley, "Total Supply by Cart Exchange," Hospitals, XLVII (November, 1973), 91.

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[5]Housley, p. 91

[6]James F. Lyons, "Hospital Studies How the Supplies Move So It Can Put People in the Proper Place," Modern Hospitals, CXXII (February, 1974), 61.

[7]Ibid.

[8]Ibid., p. 3.3-41.

[9]Housley, p. 91.

[10]Logistics Systems Branch, "Internal Distribution Systems," U. S. Army Health Service Command, Office of the DCSLOG, Fort Sam Houston, Texas, March, 1975, p. 17. (Unpublished Staff Study.)

[11]"Compartmental Exchange Cart Holds 24-Hour Stock of Supplies for Unit," Hospital Topics, LI (March, 1973), 63.

[12]Housley, p. 91.

[13]Comptroller General of the United States, Report to Congress, "Study of Health Facilities Construction Costs B-164031(3)," November 20, 1972, p. 105.

[14]Ibid.

[15]Ibid., p. 110.

[16]Swindler, p. 92.

[17]Ibid., p. 94.

[18]Ibid.

[19]Comptroller General of the United States, p. 108.

[20]Swindler, p. 95.

[21]Ingeborg Von Zitzewitz, "Conveyor and Pneumatic Tube Systems Automate Materials Handling at German Medical Center," Hospitals, XLIII (February, 1969), 86.

[22]George Spink, "A Survey of Automated Materials Distribution Systems," Hospitals, XLIII (February, 1969), 57.

[23]Interview with John Cobis, Chief Distribution Management Service, Department of Medicine and Surgery, Veterans Administration, Washington, D. C., February 5, 1975.

[24]W. J. Baker, "Is Systems Automation the Only Salvation for Hospitals?," Hospital Management, CVI (October, 1968), 82.

[25]Comptroller General of the United States, p. 111.

[26]Ibid., p. 112.

[27]Ted Isaacman, "Supplies Ride the Rails at Buffalo-Mercy Hospital," Modern Hospitals, LXXXIX (March, 1971), Reprint.

[28]Swindler, p. 98.

[29]Comptroller General of the United States, p. 117.

[30]Spink, p. 54.

[31]Swindler, p. 98.

[32]Spink, p. 53.

[33]Mathew W. Steiner, and Leon C. Pullen, "Do Automatic Materials Distribution Systems Really Save Money?," Hospitals, XLIII (February, 1969), 78.

[34]"Site Characteristics Dictate Materials Handling System Design," Hospitals, XLIX (February, 1975), 81.

[35]Housley, p. 94.

[36]Ibid., p. 78.

CHAPTER II

DISCUSSION

Central Supply

Central Supply at Methodist Hospital was located in the basement of the East Wing (Appendix A, Enclosure 2). Central Supply was operated twenty-four hours daily, seven days per week. The staff was organized under the Director of Pharmacy and included twenty-four employees (Figure 1).

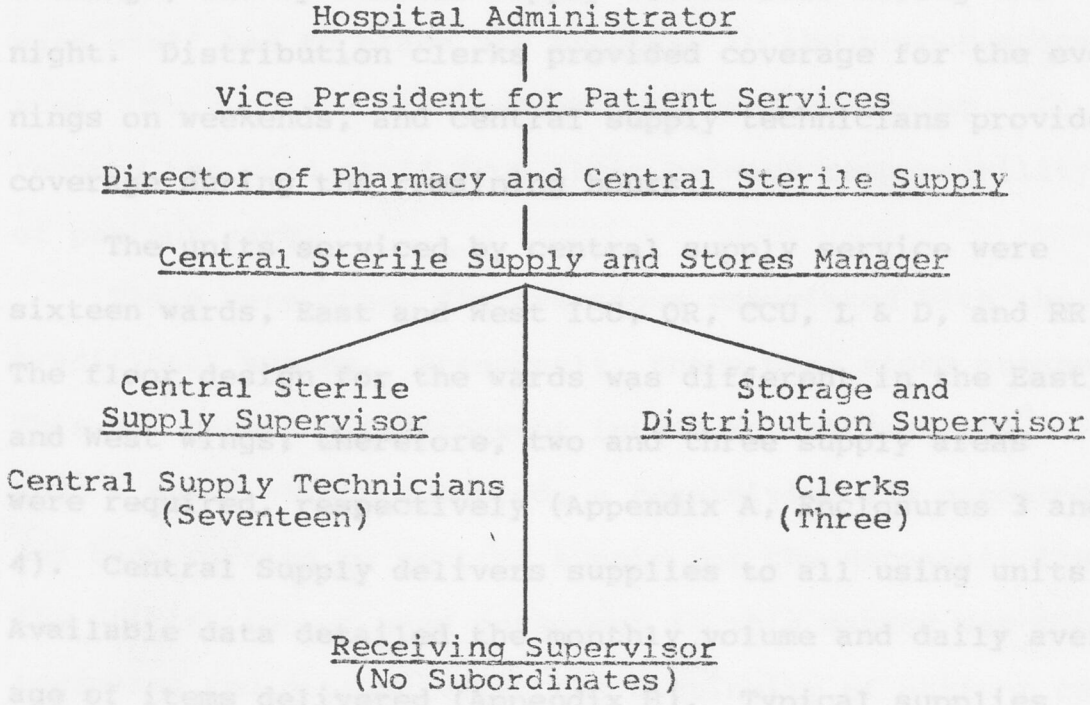


Fig. 1.--Organization of Central Supply at Methodist Hospital

The supervisor was on duty from 8:00 a.m. until 5:00 p.m., five days per week. The distribution clerks were on duty from 3:00 p.m. until 11:00 p.m., seven days per week. There were two part-time employees who worked three days per week and two full-time employees used for distribution of supplies and materials. These employees were on duty 128 man-hours per week. Thus, full coverage was provided for distribution needs by the supervisor during the day, by the distribution clerks during the evenings, and by central supply technicians during the night. Distribution clerks provided coverage for the evenings on weekends, and central supply technicians provided coverage during the remaining hours.

The units serviced by central supply service were sixteen wards, East and West ICU, OR, CCU, L & D, and RR. The floor design for the wards was different in the East and West wings; therefore, two and three supply areas were required, respectively (Appendix A, Enclosures 3 and 4). Central Supply delivers supplies to all using units. Available data detailed the monthly volume and daily average of items delivered (Appendix B). Typical supplies and materials stocked by the using units were also available (Appendix C).

There were three distribution systems utilized by central supply. The first was the traditional system. The labor and delivery area of the hospital was an example

of this system. The area had a very large supply room stocked with all necessary items. The supply room was approximately 12' by 12' in area. The system had all of the disadvantages discussed in the literature review. It required extensive utilization of personnel from the area to inventory stock. The ward staff next had to prepare extensive requisitions for the needed replacement supplies. When the requested items were delivered by by central supply service, the ward staff was again utilized to inventory and receive them. Finally, the ward staff had to place the supplies in the proper storage area. This entire process was very time consuming. It removed the ward staff from their primary responsibility of patient care.

There were other disadvantages associated with the traditional system. Frequently, there were stock outages. This was caused by infrequent inventory and resupply. When a stock outage occurred, a requisition was prepared and hand carried to central supply for the necessary item. The utilization of ward personnel in this manner was time consuming and disruptive to the continuity of patient care. An additional disadvantage of this system was that revenue was lost by the hospital. Patient charge items were properly marked, but they were frequently not charged to the patient. The infrequent inventory and resupply prevented a recall of usage information by the ward staff. These

unidentified items were charged to the using service on a monthly basis. Operating costs in the areas were correspondingly high. Management in the areas using the traditional system were seeking solutions to these problems.

The second system was a modification of traditional resupply. The operating room at Methodist functioned in this fashion. There were four supply carts in the operating room sterile area. The carts were inventoried and resupplied by an operating room technician in the same manner as the supply room in the description given above. The only variation was that the inventory and resupply occurred daily. Other disadvantages were true of this modified system. The main disadvantage was that the specialized talents of the operating room technician were being utilized as a supply clerk for several hours of each day.

The third system was the manual cart-exchange system. The carts utilized were 24" wide by 48" long by 57" high. They were open wire mesh with 6" by 2" casters. All casters rotated 360 degrees and had a polyurethane nonmarking face. There were five shelves with cardboard boxes on them to hold the supplies. Each cart had a directory indicating the supplies and material which it contained (Appendix D, Enclosure 1). The inventory listing showed the items on the cart and their exact location by shelf and position. Also included on the cart was a charge ticket basket.

Charge tickets (Appendix D, Enclosure 2) were provided by data processing for each item on the cart. The tickets were used for inventory control and for control of patient charge items. Central supply clerks were responsible for matching the inventory and charge tickets after each cart exchange. Lost revenues due to failure to charge patients for items received had been drastically reduced in areas using the cart-exchange system. Prior to the use of the cart-exchange system there were approximately $120 per month per unit in lost patient revenues. This was reduced to approximately $10 per unit after the cart-exchange system was implemented.[1] Copies of the patient charge ticket were sent to data processing, to audit, and to the cashier, as necessary, to insure proper control of patient charges.

The manual cart-exchange system was being used to distribute supplies and materials to nineteen using units. The total time required to exchange the carts, inventory, and resupply them was 14.72 man-hours (Appendix E). The time required was obtained by a time and motion study of the exchange cart system. The supervisor exchanged the two most complicated areas. They were the recovery room and the intensive care unit. The time required to exchange, inventory, and resupply these two areas was 1.10 man-hours. The remaining seventeen patient care areas were exchanged in 6.13 man-hours. These areas were exchanged by supply

clerks. Nine areas of the hospital were exchanged with carts resupplied on the previous day. Four carts were inventoried and resupplied before the remaining areas could be exchanged. After the nineteen areas had been exchanged, all of the carts in central supply were inventoried and resupplied in 7.50 man-hours. These carts were immediately available should they be needed prior to the next exchange cycle.

There were two semiautomatic systems available at Methodist Hospital. The first was the pneumatic tube system. The system in the West Wing was not functional nor was it connected to the central supply area. The system recently installed in the East Wing was a computerized Diabold pneumatic tube system. Both systems were designed for small items and for distribution of administrative paperwork. The computerized system was carrier-controlled and the older system was station-controlled.

The second semiautomated system available at Methodist Hospital was a dumbwaiter system. Dumbwaiters are small elevators designed to transport supplies and materials vertically. The dumbwaiter in the East Wing was floor level but was not large enough for the exchange carts. The dumbwaiter in the West Wing was not functional (Appendix A, Enclosures 2, 3, and 4).

Data on the flow and volume of supplies, and on the equipment available, were collected through a review of

records maintained by central supply, interviews with selected employees, and observations. The records were reports prepared by central supply over a seven-month period.

Evaluation of Alternatives

In order to determine the most effective and efficient materials distribution system for Methodist Hospital, three systems were selected for evaluation; they were (1) the traditional materials distribution system, (2) the automatic distribution systems, and (3) the manual cart-exchange system with a pneumatic tube system and dumb-waiters.

Traditional Materials Distribution System

This system was fully discussed in the literature review. It is included as an alternative because Methodist Hospital was using the system in some areas. The system could function at Methodist, however it would not effectively and efficiently meet the needs of the hospital. The traditional system required a large involvement by the professional staff, did not control patient charge items, and did not control inventory costs.

Bill Woodward, director of pharmacy, stated that:

> In those areas using the cart exchange systems roughly fifty per cent of a nurses time has been returned for direct patient care. Nurses become almost paranoid because of the time made

> available to them. They need to be retrained to properly utilize their time.[2]

The system further resulted in misutilization of manpower by multiple movements of supplies before their destination was reached. There was also a misutilization of space on the wards because of the large storage areas necessary to accomodate the required inventories. The current value of inventory on the wards if this system were utilized would be approximately $100,000.[3]

Automated Distribution Systems

Three basic automatic distribution systems were discussed in the literature review. They were the monorail, the automatic cart, and the automatic cart transport system. These systems operate twenty-four hours per day, seven days per week. They are capable of distributing all manner of supplies and materials throughout the hospital. The systems do remove completely the professional staff from the distribution of supplies and materials. However, as revealed by the literature, prior planning must be done if these systems are to be utilized effectively by a hospital.

The expense, as indicated in the literature review, of installing any of these systems into the existing plant at Methodist Hospital could exceed $2 million. The value of the plant at Methodist was approximately $22 million.[4]

The automated system in use at Audie Murphy Veterans Administration Hospital, San Antonio, Texas, exceeded $2 million in initial cost. It required a $60,000 annual maintenance contract to keep the system operational. The hospital plant and bed capacity is comparable to Methodist Hospital.[5] This, added to the difficulty in obtaining skilled maintenance employees in Lubbock, Texas, makes the automated systems undesirable. Bill Woodward, referring to the computerized pneumatic tube systems, stated, "Our maintenance employees know more about the system than the technicians sent here by Diabold."[6]

Manual Cart-Exchange System

The manual cart-exchange system was found capable of delivering the necessary supplies and materials to the using units twenty-four hours per day, seven days per week. The needs at Methodist were found to require sixty-nine carts to place the hospital on a total manual cart-exchange system (Appendix E, Enclosure 2).[7] The total number of carts needed was determined by a study of the past years utilization of supplies by area. The daily demand for supplies can be met by the use of forty-three carts in the using areas. There would be a need for twenty-five back-up carts to be maintained in central supply. The back-up carts were necessary to meet emergencies and to begin the exchange on the next cycle. The

total number of back-up carts was limited because of space requirements in central supply. Careful evaluation of the demand data indicated that eleven regular and fourteen special carts would provide the necessary back-up coverage. The eleven regular carts would contain a standardized inventory and would be used in general ward areas. The fourteen special carts would be specialized to meet the needs of particular areas. The ICUs, CCU, pediatrics, and others were found to need specialized carts.

The system would require an average time of 26.07 man-hours per day to exchange the carts, inventory, and restock them (Appendix E, Enclosure 3). The average total time required for the exchange cycle was determined by the average times per area developed in the time and motion study previously mentioned. The total time per exchange cycle was slightly weighted upward. This occurred because the nineteen areas included all of the most distant from central supply service. Therefore, the average delivery time was slightly longer than it would have been had all areas been included. The average inventory and restock time was not effected.

The total cost of the equipment and wages for the first year of operation would be $57,261 (Appendix E, Enclosure 4).[8] The cost per cart would be $401.20 or a total cost of $27,683. The cost of the trays necessary to divide and organize the carts would be an additional

$5,175. The costs are estimates based on current market price lists. The system would require three full-time and two part-time employees. This was determined by the man-hours required to operate the system. Hospital policy was to utilize college students as part-time employees. The part-time employees also assisted in scheduling week-end coverage. Hourly wages were based on the current labor market. The total first year cost would be $57,261 or $4,772 per month. The savings in lost revenue as a result of patient charge tickets and better controls would be approximately $3,500 per month.[9] This savings was determined by a projection of the estimated savings experienced by the areas of the hospital currently using the cart exchange system. The system would pay for itself in approximately sixteen months. Moreover, this does not include such reduced costs as a four to one reduction in inventory on the wards, or the reduction in lost items not chargeable to patients.[10]

It was determined that trays needed to be added to the carts to eliminate the chief complaint by the nursing staff that items were difficult to find.[11] It was determined that in addition to the listing of the inventory and its location on the cart, individual trays should be labeled with a listing of their contents. As carts were standardized, such as the regular carts, the nurses could move from ward to ward and find exact duplications. They

would encounter no difficulty in locating the correct item.

The time required to obtain items not stocked on the carts could be greatly reduced by utilizing semiautomatic systems. There were nonfunctional dumbwaiters and a pneumatic tube system in the West Building. Management had no plan to make them functional nor to connect them to the central supply area. The time required to obtain an item from central supply was a minimum of thirty minutes. This determination was made for Ward West Eight, the most distant from central supply.[12]

Summary of Major Findings

The major findings of this study, which were discussed with the management of Methodist Hospital, consisted of the following:

1. Central supply located in the basement of the East Wing, serviced twenty-four wards, the recovery room, two intensive care units, and labor and delivery.

2. The average daily supplies delivered to these units over a seven-month period ranged from 1,037 to 1,259 items.

3. The traditional distribution system was inefficient because it required professional staff involvement and large inventories on the ward, and misutilization of floor space.

4. The automated systems were determined to have very high initial cost and to require highly technical maintenance personnel.

5. The Manual Cart Exchange System was found to require 69 carts, 26.07 man-hours per day, and would cost $57,261 for the first year for equipment and staff.

6. The dumbwaiters and pneumatic tube systems in the West Building were found inoperable, and there were no plans to make them operable.

Footnotes

[1]Interview with Marvin C. Hardin, Vice President of Patient Care Services, Methodist Hospital, Lubbock, Texas, March 4, 1975.

[2]Interview with Bill Woodward, Director of Pharmacy, Methodist Hospital, Lubbock, Texas, March 6, 1975.

[3]Interview with Al Gonzales, Supervisor of Cart Exchange and Stores, Methodist Hospital, Lubbock, Texas, March 7, 1975.

[4]Hardin interview.

[5]Interview with James Blehm, Chief of Materials Distribution, Audie Murphy Veterans Administration Hospital, San Antonio, Texas, February 21, 1975.

[6]Woodward interview.

[7]Interview with Dan Holubeck, Manager of Central Sterile Supply and Stores, Methodist Hospital, Lubbock, Texas, March 7, 1975.

[8]Ibid.

[9]Hardin interview.

[10]Gonzales interview.

[11]Interview with Mrs. Sybil Foster, R.N., Assistant Patient Care Coordinator, Recovery Room, Methodist Hospital, Lubbock, Texas, March 11, 1975.

[12]Interview with Mrs. Rosemary Dyches, R.N., Staff duty nurse, Methodist Hospital, Lubbock, Texas, March 11, 1975.

CHAPTER III

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The best method for material distribution at Methodist Hospital, Lubbock, Texas, is the manual cart-exchange system combined with semi-automatic pneumatic tube and dumbwaiter systems.

Recommendations

The following recommendations are made:

1. The manual cart exchange system should be fully implemented at Methodist Hospital.

2. The semiautomatic pneumatic tube system in the West Building should be made functional and be connected to the central supply area.

3. The semiautomatic dumbwaiter should be made functional and accessible to personnel from central supply and the using services in the West Building.

4. The semiautomatic systems should be utilized by all services for requests and delivery of items from central supply and not stocked on the carts.

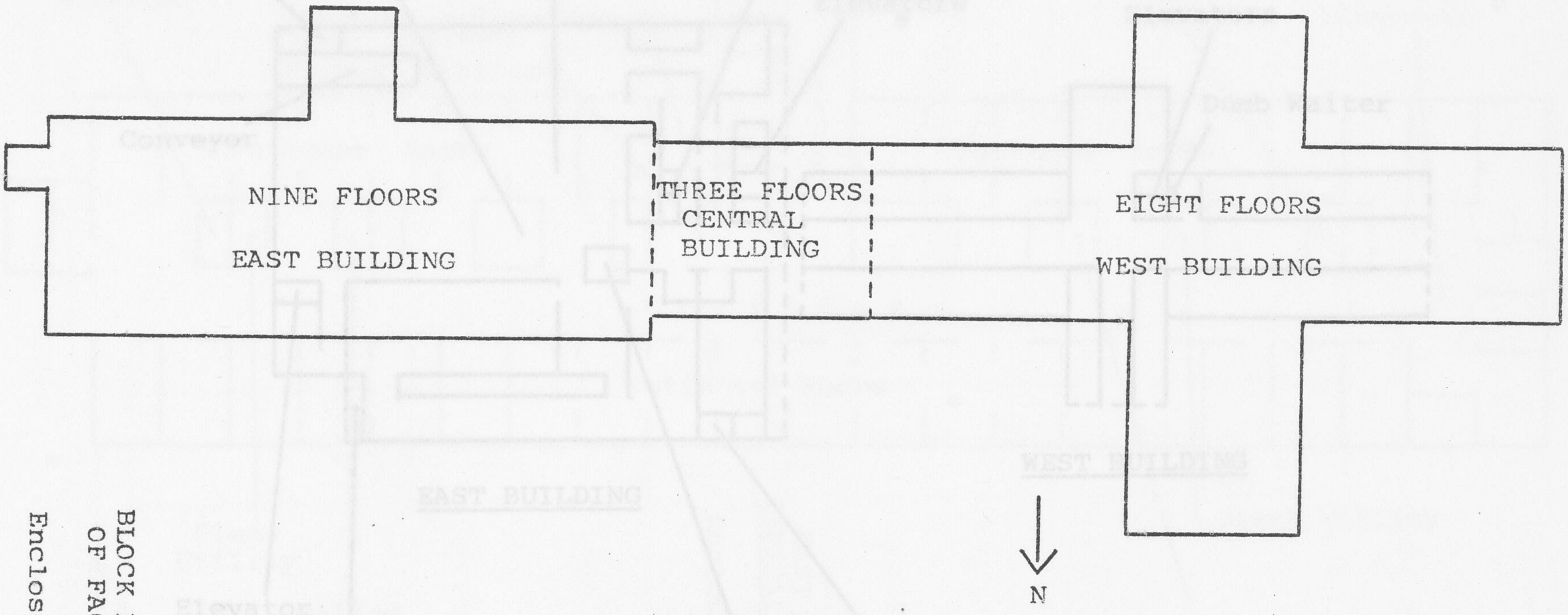
Recommendation For Further Study

It is recommended that future studies be conducted to determine the use of the manual cart exchange for:

1. Small pieces of equipment.
2. Laundry and linen.
3. Administrative forms and supplies.

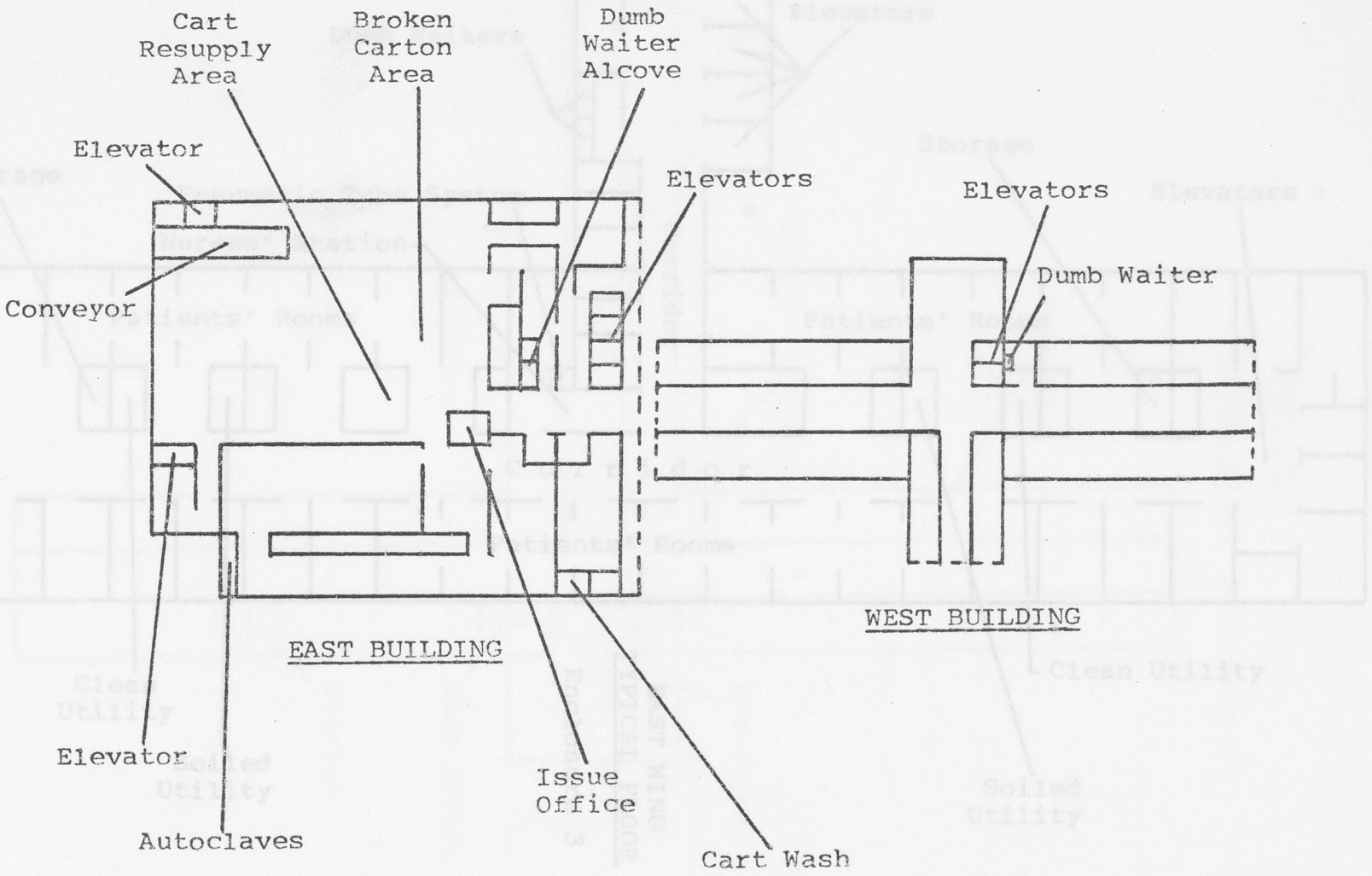
APPENDIX A

METHODIST HOSPITAL FLOOR PLANS



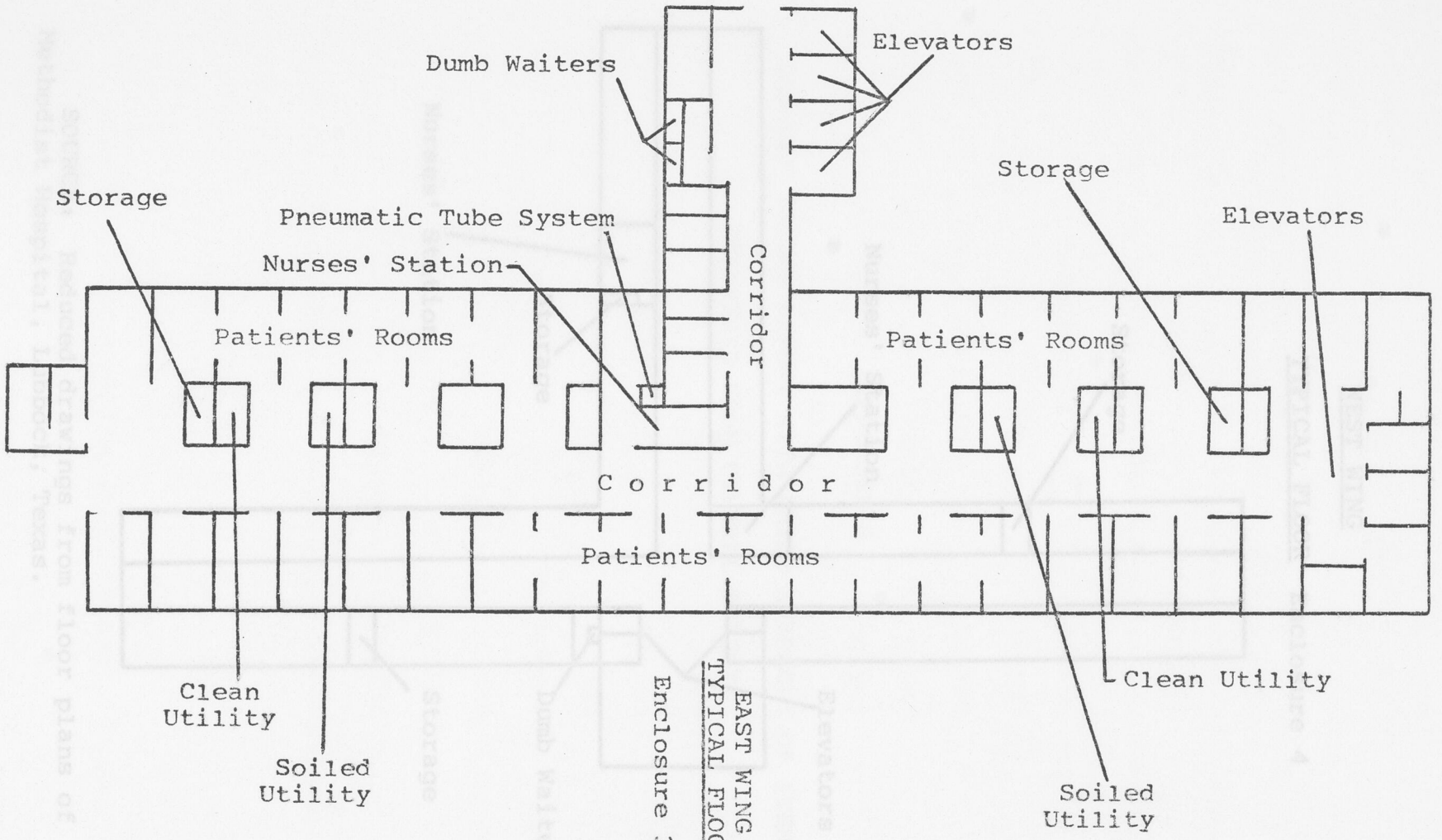
BLOCK DIAGRAM
OF FACILITY

Enclosure 1



BASEMENT AREA

Enclosure 2

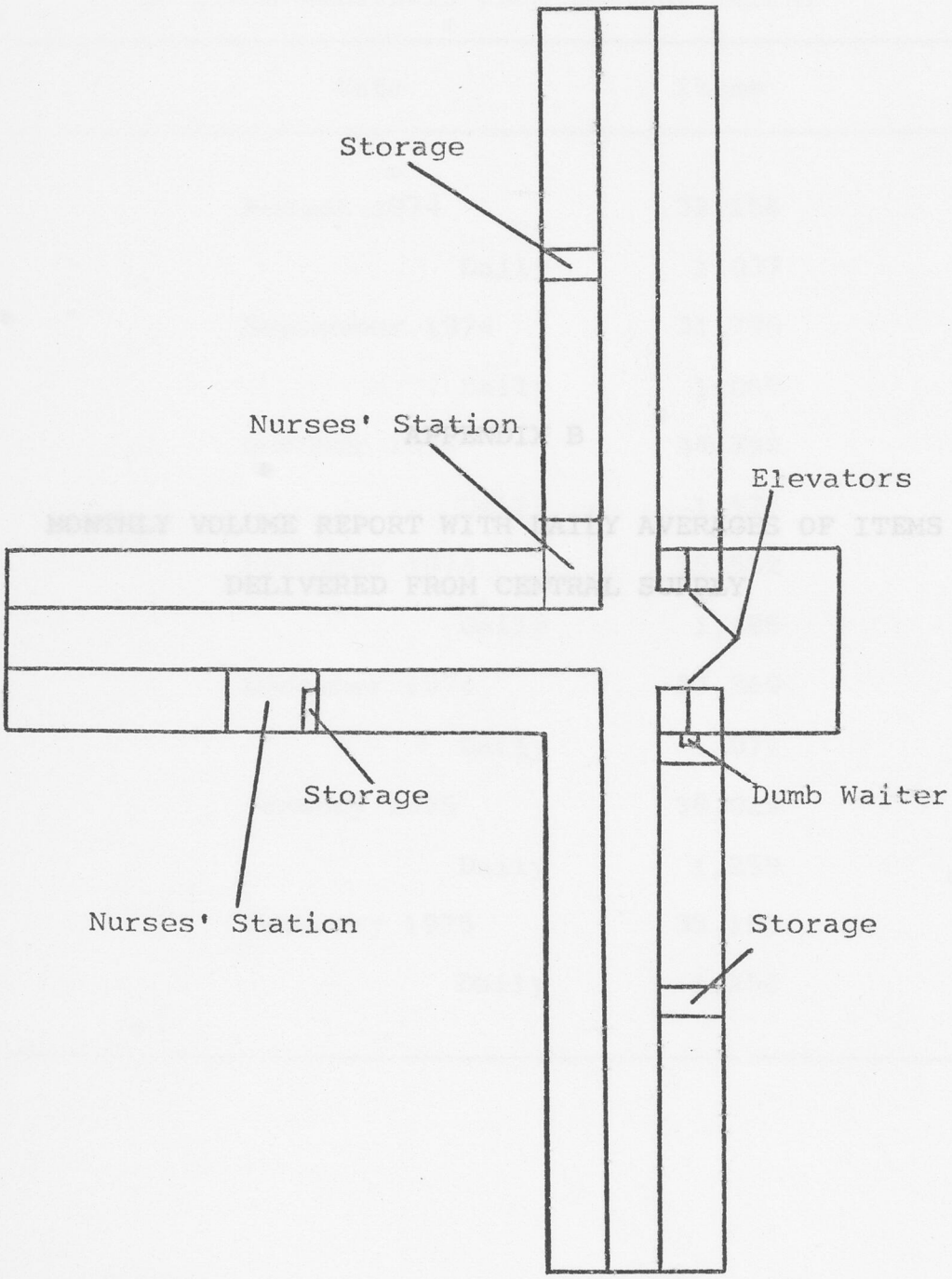


EAST WING
TYPICAL FLOOR

Enclosure 3

WEST WING

TYPICAL FLOOR Enclosure 4



SOURCE: Reduced drawings from floor plans of Methodist Hospital, Lubbock, Texas.

APPENDIX B

MONTHLY VOLUME REPORT WITH DAILY AVERAGES OF ITEMS DELIVERED FROM CENTRAL SUPPLY

APPENDIX B

MONTHLY VOLUME REPORT WITH DAILY AVERAGES OF ITEMS DELIVERED FROM CENTRAL SUPPLY

Date	Items
August 1974	32,156
Daily	1,037
September 1974	31,796
Daily	1,060
October 1974	34,893
Daily	1,126
November 1974	35,552
Daily	1,185
December 1974	33,369
Daily	1,077
January 1975	39,025
Daily	1,259
February 1975	35,158
Daily	1,256

SOURCE: Methodist Hospital, Lubbock, Texas.

APPENDIX C

SUPPLIES AND MATERIALS STOCKED

BY USING UNITS

Intensive Care Unit

Description	Stock Level
Linen Savers, Large	10 pk.
J. D. Pack Heavy Lister	20 ea.
Chest-Bottle Set-up 2 w/Rack & Clamp	2 bx.
Chest-Bottle Set-up 1 bottle w/Rack & Clamp	1 bx.
Connecting Tubes	24 ea.
Yankayer Suction Tubes	4 ea.
Dermiclear Tape 1/2 inch	3 rl.
Dermiclear Tape 1 inch	3 rl.
Dermiclear Tape 2 inch	3 rl.
Bandaid Dressing 4 x 6	12 ea.
Telfa Dressing 4 x 3	10 ea.
Surgipan 7-1/2 x 8	2 ea.
Bandaid Dressing 8 x 6	18 ea.
Surgipad 5 x 9	4 ea.
Salem Sump Tube 18 fr.	6 ea.
Salem Sump Tube 16 fr.	4 ea.
Montgomery Straps	6 sht.
Medium Lister	10 ea.
Prep Tray	4 ea.
Vaseline Gauze 3 x 9	12 ea.
Vaseline Gauze 3 x 18	12 ea.
Topper Dressing	20 ea.
Sponge Gauze 4 x 4	50 ea.
Sponge Gauze 4 x 4 - per box	2 bx.
Suture Removal Set Disp.	4 ea.
Bandage Gauze 1 inch	1 rl.
Bandage Gauze 3 inch	2 rl.
Bandage Gauze 4 inch	2 rl.
Sanitary Belt	2 ea.
Adhesive Tape 1/2 inch	1 rl.
Adhesive Tape 1 inch	3 rl.
Adhesive Tape 1-1/2 inch	1 rl.
Adhesive Tape 3 inch	1 rl.
Nu-Gauze Iodoform 1/2 inch	2 ea.
Nu-Gauze Iodoform 1 inch	2 ea.
Ace Bandage 3 inch	4 ea.
Ace Bandage 4 inch	4 ea.
Ace Bandage 6 inch	4 ea.
Sanitary Napkins V-Pads	2 doz.
Lemon & Glycerine Swabs	12 pkg.
Culturette Swabs	4 ea.
Toothettes	20 ea.
Lotion	10 bt.

Description	Stock Level
Safety Pins 6-Irg. 6 med.	12 pkg.
Straight Connector 5/16	6 ea.
Sims Connector	2 ea.
Stop Cock 3-way Disp.	5 ea.
Gauze Roll 1 inch	6 rl.
Gauze Roll 2 inch	4 rl.
Gauze Roll 3 inch	4 rl.
Steri-Strip 1/2 x 4 inch	4 ea.
Aspirating Tube	2 ea.
Mucus Trap	2 ea.
Vaginal Irrigation Unit	1 ea.
Trach Ties	6 ea.
Trach Plugs	3 ea.
Connector 5-1	6 ea.
Connector - Y 3/8	6 ea.
Catheter Plug	4 ea.
Nasal Airway 28 fr.	1 ea.
Nasal Airway 30 fr.	1 ea.
Nasal Airway 32 fr.	1 ea.
Nasal Airway 34 fr.	1 ea.
Aero-Flow Suction Catheter	12 ea.
Hose-Clamp	12 ea.
Wrist Restraints	6 ea.
Posey Vest Large	2 ea.
Heel Protector-Sheepskin	4 pr.
Heel Protector-Foam Rubber	2 pr.
Posey Vest-Medium	6 ea.
Towel, Sterile	12 ea.
Jobst Stocking A-1	2 pr.
Jobst Stocking A-2	2 pr.
Jobst Stocking A-3	2 pr.
Jobst Stocking B-1	2 pr.
Jobst Stocking B-2	2 pr.
Jobst Stocking B-3	2 pr.
Stocking Support Elastic Black	2 pr.
Kerlix Roll	12 rl.
Sputum Collection	5 ea.
Midstream Specimen Tray	2 ea.
Specimen Container	10 ea.
Silastic Catheter 16 fr.	6 ea.
Silastic Catheter 18 fr.	6 ea.
Silastic Catheter 20 fr.	6 ea.
Suction Catheter 14 fr.	6 ea.

Description	Stock Level
Suction Catheter 10 fr.	2 ea.
Suction Catheter 18 fr.	2 ea.
Syringe 30 cc Disp.	2 bx.
Stomach Tube Levine Type 16 fr.	4 ea.
Airway Newborn	1 ea.
Airway Child	3 ea.
Airway Medium	3 ea.
Airway Large	4 ea.
Feeding Tube 8 fr.	6 ea.
Fuller Shield	2 ea.
Stylex Syringe 50 cc Disp.	10 ea.
Syringe 50 cc Disp.	5 ea.
Closed Drainage Unit	6 ea.
Catheter Tray with Catheter	3 ea.
Irrigation Tray	12 ea.
Catheter Tray without Catheter	6 ea.
Chest Valve Disp.	1 ea.
Trach Suction Tray	15 ea.
CDU Bag w/o Drain	3 ea.
Urimeter	3 ea.
Enema Unit	3 ea.
Trach Tube Portex 24 fr.	2 ea.
Trach Tube Portex 27 fr.	1 ea.
Trach Tube Portex 30 fr.	1 ea.
Trach Tube Portex 33 fr.	1 ea.
Trach Tube Portex 36 fr.	2 ea.
Trach Tube Portex 39 fr.	1 ea.
Trach Tube Size 1	1 ea.
Trach Tube Size 3	1 ea.
Trach Tube Size 4-1/2	1 ea.
Trach Tube Low Pressure 6	2 ea.
Trach Tube Low Pressure 4	2 ea.
Trach Tube Low Pressure 8	2 ea.
Trach Tube Low Pressure 10	2 ea.
Trach Tube Hi-Pressure 4	2 ea.
Trach Tube Hi-Pressure 6	2 ea.
Trach Tube Hi-Pressure 8	2 ea.
Trach Tube Hi-Pressure 10	2 ea.
Tongue Blades	20 pk.
Kleenex	10 bx.
Foley Catheter 16 fr.	1 ea.
Foley Catheter 18 fr.	5 ea.
Foley Catheter 20 fr.	2 ea.

Description	Stock Level
Cath. Silicon 16 fr 5 cc Bag 2 ways	2 ea.
Cath. Silicon 18 fr 5 cc Bag 2 ways	2 ea.
All Purpose Catheter Small	4 ea.
All Purpose Catheter Medium	6 ea.
All Purpose Catheter Medium	2 pkg.
Enema Soap	6 ea.
Battery, Flashlight, Large	6 ea.
Battery, Flashlight, Small	2 ea.
Blades, Double-Edge	2 ea.
Jelly, Lubricating	1 bx.
Bandaid 3/4 X 3 inch	1 bx.
Swabs Preptic	4 bx.
Thermometer Oral	6 ea.
Thermometer Rectal	10 ea.
Soda, Baking	1 ea.
Salt	1 ea.
Fleets Enema	3 ea.
Thermometer, Jar	4 ea.
Denture Cup	10 ea.
Alcohol	2 bt.
Peroxide	1 bt.
Cup, Portion	1 bx.
Cup, Cold 6 oz.	3 pkg.
Cup, Hot Drink	4 pkg.
Cup, Medicine Plastic	2 pkg.
Glass, Plastic in and out	25 ea.
Straw, Flex	1 bx.
Gloves, Surgical 6-1/2	6 pr.
Gloves, Surgical 7	6 pr.
Gloves, Surgical 7-1/2	6 pr.
Gloves, Surgical 8	5 pr.
Sterile Gloves	1 bx.
Unsterile Gloves	1 bx.

Intensive Care Unit--Solution

Description	Stock Level
Subclavian Buffer Changeover Set B	10
Sterile Water for Irrigation 500 cc	24
Additive Soluset 250, Twin Tube	2
Additive Piggy Backs	15
Y-Type Blood Adm. Set	7
Venoset Microdrip	6
Straight Blood Infusion Set	2
Soluset - P-100	3
Butterfly 23 ga.	6
Butterfly 21 ga.	20
Butterfly 19 ga Int.	3
Butterfly 19 ga.	10
Butterfly 25 ga.	6
Butterfly 21 ga Int.	6
Subclavian Buffer Set A	10
Venikit 21 ga.	4
Venikit 19 ga.	2
Abbocath-T 18 ga.	4
Abbocath 20 ga.	4
Short Arm Board	6
Full Arm Board	6
Cup Manometer	3
Venotube 30 inch	10
Rheomacrodex 10% in Water	1
Rheomacrodex 10% in Saline	1
SAIF Filter Set	26
Surgical Venoset	20
10% Dextrose Injection 500 ml.	1
10% Dextrose Injection 1000 ml.	2
Intracath Med.	5
Intracath Large	3
Longdwel Needle 18 ga.	10
Longdwel Needle 20 ga.	10
Ringer's Injection 1000 cc	2
Normosol M & Surbex-T in D-5-W 1000 ml.	2
Dextrose 5% in Water 100 ml.	3
Pentathol Dispensing Pin	3
Lactated Ringer's 1000 cc	2
Normal Saline 0.9% 250 cc	6
Normal Saline 0.9% 500 cc	2
Normal Saline 0.9% 1000 cc	3
Dextrose 5% in 1/2 Saline 1000 cc	5
Surbex-T and Dextrose 5% 1000 cc	5

Description	Stock Level
Dextrose 5% in Saline 0.9% 1000 cc	6
Dextrose 5% in Saline 0.9% 500 cc	5
Dextrose 5% in 1/4 Saline 1000 cc	15
Sterile Water for Irrigation 1500 cc	10
Sodium Chloride for Irrig. 1500 cc	10
Sodium Chloride for Irrig. 500 cc	5
Dextrose 2-1/2% in 1/2 Lactated Ring. 1000 cc	15
Normosol M in Dextrose 5% 1000 cc	10
Dextrose 5% in Lactated Ringers 1000 cc	18
Dextrose 5% in Lactated Ringers 500 cc	6
Dextrose 5% in Water 1000 cc	10
Dextrose 5% in Water 500 cc	20
Dextrose 5% in Water 250 cc	10

General

Description	Stock Level
Glycine	2 Bags
Medium Lister	12 ea
Topper Sponges	10 ea.
4 X 4 Gauze Sponge (2/pkg.)	12 pkg.
Bandaid Dressing 4 X 6	6 ea.
Bandaid Dressing 8 X 6	6 ea.
Lister Heavy Dressing Pak. JD.	6 ea.
Towel, Sterile	3 ea.
4 X 4 Gauze Sponge (25/pk)	1 bx.
Prep Tray	4 ea.
Kerlix Roll Sterile	3 ea.
Tissue Facial Kleenex	6 bx.
Closed Drainage Unit	2 ea.
Cath. Tray w/o Cath.	2 ea.
Lotion, Intensive Care	4 ea.
Enema, Fleet	2 ea.
Cath. Tray with Cath.	2 ea.
Dermiclear Tape 1 inch.	2 rl.
Dermiclear Tape 2 inch	2 rl.
Dermiclear Tape 1/2 inch	2 rl.
Enema Soap Packet	4 ea.
Enema Bucket	2 ea.
Irrigation Tray Disp.	4 ea.
Abbocath - 18 gauge	2 ea.
Abbocath - 20 gauge	2 ea.
Abbocath - 16 gauge	2 ea.
Syringe 50 cc Luer Lok - Disp.	2 ea.
Lemon & Glycerine Swabs	2 ea.
Ace Elastic Bandage 2 inch	2 ea.
Ace Elastic Bandage 3 inch	2 ea.
Ace Elastic Bandage 4 inch	4 ea.
Ace Elastic Bandage 6 inch	4 ea.
Gloves Surgical 6-1/2	2 pr.
Gloves Surgical 7	2 pr.
Gloves Surgical 7-1/2	2 pr.
Gloves Surgical 8	2 pr.
Gloves Surgical 8-1/2	2 pr.
Tongue Blades	4 pkg.
Cotton Bud Applicators, Sterile	10 pkg.
Steri-Strip 1/2 X 4 inch	2 pkg.
Specimen Container Disp.	4 ea.
Heel Protectors Sheepskin	2 pr.
Y-type Blood Adm. Set	2 ea.

Description	Stock Level
Batteries - Flashlight - Regular	2 ea.
Batteries - Flashlight - Small	2 ea.
Double Edge Blade (5/pkg)	2 ea.
Sexto Blades	2 pkg.
Safety Pins	2 pkg.
Thermometer - Rectal	6 ea.
Thermometer, Oral	6 ea.
Cup, Specimen	10 ea.
Adhesive Tape, 1/2 inch	2 rl.
Adhesive Tape, 1 inch	2 rl.
Adhesive Tape, 1-1/2 inch	2 rl.
Adhesive Tape, 3 inch	2 rl.
Micropore Surgical Tape, 1 inch	2 rl.
Thermometer Jar	2 ea.
All Purpose Cath. - Small	2 ea.
All Purpose Cath. - Medium	12 ea.
Cath. Foley 5 cc 2 way 16 fr.	2 ea.
Cath. Foley 5 cc 2 way 18 fr.	2 ea.
Cath. Foley 5 cc 2 way 14 fr.	2 ea.
Cath. Coude 20 fr.	1 ea.
Cath. Coude 18 fr.	1 ea.
Cath. Coude 16 fr.	1 ea.
Cath. Silastic Foley 15 fr. 5 cc	2 ea.
Cath. Silastic Foley 18 fr. 5 cc	2 ea.
Cath. Silastic Foley 20 fr. 5 cc	2 ea.
Intra Cath. Medium	1 ea.
Intra Cath. Small	1 ea.
Intra Cath. Large	1 ea.
Betadine Solution	2 bt.
Kidney Stone Filter	12 ea.
Merthiolate	2 bt.
Small Furacin Pan	1 ea.
NuGauze Iodoform 1 inch	1 ea.
NuGauze Iodoform 1/2 inch	1 ea.
NuGauze Iodoform 1/4 inch	1 ea.
Alcohol, Rubbing - Lavacol	2 bt.
Peroxide	1 bt.
Benzoin Spray	1 bt.
Posey Vest - Medium	1 ea.
Posey Vest - Large	1 ea.
Telepaque Tablets	1 bx.
Vaginal Irrigation Unit	1 ea.
Sputum Collection System	2 ea.

Description	Stock Level
Hose Clamps	12 ea.
Bandage Triangular	1 ea.
Nail Polish Remover Pads	1 bx.
Jelly, Lubricating	1 bx.
Arm Sling Disp. Med.	1 ea.
Arm Sling Disp. Large	1 ea.
Vaseline	2 bt.
Bandaid 3/4 X 3	1 bx.
Bandaid 2 inch	1 bx.
Catheter Plugs	4 ea.
Invalid Ring - Disp.	2 ea.
Surgipad 5 X 9	2 ea.
Levine Type Stomach Tube 18 fr.	1 ea.
Telfa Dressing - 8 X 3	1 ea.
V-Pads (per dozen)	1 dz.
Suction Catheter 14 fr.	2 ea.
Sump Tube 16 fr. Salem	1 ea.
Sump Tube 18 fr. Salem	1 ea.
Connector 3/8 Y	1 ea.
Connector 5 in 1	1 ea.
Cotton Balls	2 pkg.
Gauze Roll Bandage 2 X 10	2 ea.
Gauze Roll Bandage 1 X 10	2 ea.
Eye Pads	2 ea.
Sanitary Belt	1 ea.
Bandage Gauze 4 inch (Kling)	1 rl.
Bandage Gauze 3 inch (Kling)	1 rl.
Catheter Adapter	2 ea.
Vaseline Gauze 3 X 9 inch	2 ea.
Vaseline Gauze 3 X 18 inch	2 ea.
Midstream Specimen Tray	2 ea.
Culturette Cepti-Seal Swabs	2 ea.
Airway Child	1 ea.
Airway Medium	1 ea.
Airway Large	1 ea.
Stylex Syringe	2 ea.
Montgomery Straps	2 ea.
Flatus Evacuation Bag	1 ea.
Clip Set	1 ea.
Stokinette 6 inch	1 ea.
Stocking Jobst - Anti-Emb. A-1	1 pr.
Stocking Jobst - Anti-Emb. A-2	1 pr.
Stocking Jobst - Anti-Emb. A-3	1 pr.

Description	Stock Level
Stocking Jobst - Anti-Emb. B-1	1 pr.
Stocking Jobst - Anti-Emb. B-2	1 pr.
Stocking Jobst - Anti-Emb. B-3	1 pr.
Trach. Suction Tray	1 bx.
Arm Board - Short	2 ea.
Arm Board - Long	2 ea.
Suture Set - Disposable	3 ea.
Dextrose 5% - Lactated Ringers 1000 ml	4 bt.
Dextrose 5% - Lactated Ringers 500 ml	1 bt.
Dextrose 5% - 1/4 NACL 1000 ml	2 bt.
Dextrose 5% - 0.9 NACL 500 ml	1 bt.
Dextrose 5% - 0.9 NACL 1000 ml.	2 bt.
Dextrose 5% - Water 250 ml	4 bt.
Sodium Chloride 250 ml	2 bt.
Sodium Chloride 500 ml	1 bt.
Sodium Chloride 1000 ml	1 bt.
Normosol - M-D-S 1000 ml	4 bt.
Dextrose 5% - Water 100 ml	3 bt.
Pentathol Disp. Pin	3 ea.
Dextrose 5% - Water 500 ml	2 bt.
Dextrose 5% - Water 1000 ml	4 bt.
2-1/2 Dextrose in 1/2 Lact. Ring. 1000 ml	2 bt.
Surbex-T in 5% Dextrose 1000 ml	1 bt.
Lactated Ringers 1000 ml	1 bt.
Dextrose 5% 1/2 NACL 1000 ml	2 bt.
Sodium Chloride - Irrig. 1500 ml	2 bt.
Sterile Water - Irrig. 1500 ml	2 bt.
1/2 Sodium Chlorine-M 1000 ml	1 bt.
Dextrose 10% Water 1000 ml	1 bt.
10% Dextran 40--09 NACL Inj. 500 ml	1 bt.
10% Dextran 40--5% Dextrose 500 ml	1 bt.
Butterfly Infusion Set 25 Ga	1 ea.
Butterfly Infusion Set 19 Ga	4 ea.
Butterfly Infusion Set 21 Ga	4 ea.
Butterfly Infusion Set 19 Ga INT	2 ea.
Butterfly Infusion Set 21 Ga INT	2 ea.
Venikit 19 Ga	4 ea.
Venikit 21 Ga	4 ea.
Swabs, Preptic	1 bx.
Soluset Additive	6 ea.
Venotube 30 inch	1 ea.
Longdwell Needle 16 Ga	2 ea.
Longdwell Needle 18 Ga	2 ea.

Description	Stock Level
Longdwell Needle 20 ga	2 ea.
Venoset Microdrip	2 ea.
Surgical Venoset	6 ea.
Soluset 250	2 ea.
Linen Saver, Large	6 pkg.
Pitchers	3 ea.
Fracture Pan	3 ea.
Urinal	3 ea.
Bed Pan	3 ea.
Denture Cups	4 ea.
Hot, Cup	4 bx.
Cold, Cup	1 bx.
Salt	1 bx.
Ad-hes-away	1 cn.
Soda, Baking	1 bx.
Corn Starch	1 bx.
Straws, Flex	1 bx.
Cups, Portion	1 bx.
Cups, Medicine	1 bx.
Glass, Graduated I & O	25 ea.
Sterile Exam Gloves	1 bx.
Unsterile Exam Gloves	1 bx.
Soap Powder	1 bx.
Ajax	1 cn.
Phisohex	1 gl.

APPENDIX D

FORMS CURRENTLY IN USE AT METHODIST HOSPITAL

INVENTORY ON CARTS WITH LOCATION INDICATED

Enclosure 1

Nursing Unit: W5 E&N Pedi

FLOOR CARTS

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
Top	Chux, Baby Diapers per dz	16062	6 dz					.53
	Chux, Pre Fold Diapers	16209	6 dz					.56
	U - Bags - Pediatric	7053-2	1 bx					4.60
	Baby Powder	7114-2	4 ea					.14
	Baby Lotion	7112-6	4 ea					.72
	Baby Shampoo	7113-4	4 ea					.78
A-1	Medium Lister	16177	12 ea					.20
	Topper sponges	16296	10 ea					.04
	4 x 4 Gauze Sponge (2/pkg)	16129	12 pkg					.05
	Bandaid Dressing 4 x 6	16026	6 ea					.19
	Bandaid Dressing 8 x 6	16027	6 ea					.28
	Lister Heavy Dressing Pak - JD	16176	6 ea					.45
	Towel, Sterile	16297	3 ea					.05
	4 x 4 Gauze Sponge (25/bx)	16731	1 bx					1.29
	Prep Tray	16239	4 ea					.45
	Kerlix Roll, Sterile	16162	3 ea					.58
A-2	Tissue, Facial Kleenex	16244	6 bx					.14
	Closed Drainage Unit	16066	2 ea					1.95
	Cath Tray w/o Cath	16515	2 ea					1.20
	Lotion, Intensive Care	16188	4 btl					.26
	Enema Fleets Pedi	16104	4 ea					.45
	Enema, Fleets	16102	2 ea					.34
	Cath Tray with Cath	16051	2 ea					1.33
	Dermiclear Tape 1 inch	16533	2 rl					.36

Nursing Unit W5 E&N Pedi

FLOOR CARTS Page 2 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Contaminated	Cost
A-2	Dermiclear Tape 2 inch	16537	2 rl					.72
	Dermiclear Tape 1/2 inch	16024	2 rl					.18
	Enema Soap Packet	16105	4 ea					.03
	Enema Bucket	16101	2 ea					.67
	Irrigation Tray Disp	16154	4 ea					.89
A-3	Abbocath - 18 Ga	16941	2 ea					1.08
	Abbocath - 20 Ga	19942	2 ea					1.08
	Abbocath - 16 Ga	16940	2 ea					1.08
	Syringe 50 cc Luer-Lok-Disp	16280	2 ea					.49
	Lemon & Glycerine Swab	16169	2 ea					.14
	Ace Elastic Bandage 2 inch	16001	2 ea					.36
	Ace Elastic Bandage 3 inch	16003	2 ea					.49
	Ace Elastic Bandage 4 inch	16004	4 ea					.63
	Ace Elastic Bandage 6 inch	16005	4 ea					.86
	Gloves, Surgical 6-1/2	16134	2 pr					.47
	Gloves, Surgical 7	16614	2 pr					.47
	Gloves, Surgical 7-1/2	16615	2 pr					.47
	Gloves, Surgical 8	16616	2 pr					.47
	Gloves, Surgical 8-1/2	16635	2 pr					.47
	Tongue Blades	16294	6pkg					.02
	Cotton Bud Applicator, Sterile	16080	20 pkg					.01
	Steri-Strip 1/2 x 4 inch	16259	2 pkg					.47
	Specimen Container Disp	16253	4 ea					.14
	Heel Protectors Sheepskin	16141	2 pr					5.75
	Y-Type Blood Adm. Set	16232	2 ea					1.39
	Cision Dressings	16323	2 ea					2.52

Nursing Unit W5 E&N Pedi FLOOR CARTS Page 3 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
A-4	Batteries - Flashlight - Regular	7015-1	2 ea					.20
	Batteries - Flashlight - Small	7017-7	2 ea					.20
	Double Edge Blade (5/pkg)	7019-3	2 pkg					.12
	Sexto Blades	7021-9	2 pkg					.30
	Safety Pins Large	16223	12 pkg					.05
	Thermometer, Rectal	7187-8	6 ea					.51
	Thermometer, Oral	7185-2	6 ea					.54
	Cup, Specimen	17037-3	10 ea					.02
	Adhesive Tape 1/2 inch	16527	2 rl					.13
	Adhesive Tape 1 inch	16528	2 rl					.25
	Adhesive Tape 1-1/2 inch	16529	2 rl					.35
	Adhesive Tape 3 inch	16530	2 rl					.75
	Micropore Surgical Tape 1 inch	16193	2 rl					.44
B-1	All-Purpose Cath - Small	16015	2 ea					1.33
	Cath Pedi Foley 10 fr	16595	2 ea					3.26
	Cath Pedi Foley 8 fr	16048	2 ea					3.26
B-2	Kidney Stone Filter	16164	12 ea					.06
	Merthiolate	21921	2 btl					.28
	Small Furacin Pan	16119	1 ea					2.20
	Nu Gauze Iodoform 1 inch	16208	1 ea					1.07
	Nu Gauze Iodoform 1/2 inch	16207	1 ea					.94
	Nu Gauze Iodoform 1/4 inch	16489	1 ea					.89

Nursing Unit W5 E&N Pedi FLOOR CARTS Page 4 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
B-2	Alcohol Rubbing - Lavacol	16486	2 btl					.38
	Peroxide	21525	1 btl					.33
	Betadine Solution		2 btl					.60
	Posey Vest - Medium	16130	1 ea					7.50
	Posey Vest - Large	16201	1 ea					7.50
	Telepaque Tablets	20043-6	1 bx					19.48
	Sputum Collection System	16488	2 ea					.46
	Hose Clamps	7051-6	12 ea					.37
	Bandage Triangular	16018	1 ea					.58
	Jelly, Lubricating	7107-6	1 bx					5.08
	Armsling Disp - Medium	16694	1 ea					1.95
	Armsling Disp- Small	16017	1 ea					1.95
	Vaseline	23481	2 btl					.20
	Bandaid 3/4 x 3	16022	1 bx					1.33
	Nail Polish Remover Pads	16165	1 bx					1.00
B-3	Catheter Plugs	16050	4 ea					.08
	Invalid Ring - Disp	16153	2 ea					.92
	Surgipad - 5 x 9	16273	2 ea					.06
	Telfa Dressing 8 x 3	16289	1 ea					.47
	Suction Catheter 10 fr	16270	2 ea					.77
	Sump Tube 16 fr Salem	16431	1 ea					.77
	Sump Tube 18 fr Salem	16447	1 ea					.43
	Connector 3/8 Y	16419	1 ea					.33
	Connector 5 in 1	16413	1 ea					.33
	Feeding Tube 5 fr	16113	1 ea					.37
	Feeding Tube 8 fr	16610	1 ea					.36

Nursing Unit W5 E&N Pedi

FLOOR CARTS

Page 5 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
B-4	Cotton Balls	16079	6 pkg					.30
	Gauze Roll Bandage 2 x 10	16125	2 ea					.24
	Gauze Roll Bandage 1 x 10	16128	2 ea					.13
	Eye Pads	16108	2 ea					.09
	Bulb Syringe	16283	1 ea					.43
	Bandage Gauze 4 inch (Kling)	16744	1 rl					.34
	Bandage Gauze 3 inch (Kling)	16732	1 rl					.28
	Catheter Adapter	16832	2 ea					.57
	Vaseline Gauze 3 x 9 inch	16324	2 ea					.26
	Vaseline Gauze 3 x 18 inch	16325	2 ea					.28
	Midstream Specimen Tray	16990	2 ea					.32
	Culturette Cepti-Seal Swabs	16089	2 ea					.15
	Airway Child	16014	1 ea					.50
	Airway Infant	16771	1 ea					.50
	Airway Pedi	16770	1 ea					.50
	Airway Medium	16773	1 ea					.50
	Airway Newborn	16772	1 ea					.50
	Stylex Syringe	16279	2 ea					.50
	Montgomery Straps	16197	2 sh					.42
	Clip Set	16541	1 ea					.50
	Suture Removal Set	16276	2 ea					.50
	Trach Suction Tray	16421	1 bx					.75
	Arm Boards Large	16786	4 ea					.18
	Arm Boards Small	16785	4 ea					.25

Nursing Unit W5 E&N Pedi FLOOR CARTS Page 6 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
C-1	Dextrose 5% - Lactated Ringers 500 ml	16351	6 btl					1.33
	Dextrose 5% - 1/4 NACL 500 ml	16353	2 btl					1.19
	Dextrose 5% - 0.9 NACL 500 ml	16356	2 btl					1.19
	Dextrose 5% in water 100 ml	19001-7	3 btl					.52
	Pentathol Dispensing Pen	7264-5	3 ea					.20
C-2	Dextrose 5% in water 250 ml	16358	4 btl					.96
	Sodium Chloride 250 ml	16392	2 btl					.93
	Sodium Chloride 500 ml	16393	1 btl					1.06
	Normosol - M - D-5 500 ml	16377	3 btl					2.04
C-3	Dextrose 5% Water 500 ml	16359	6 btl					1.11
	2-1/2 Dextrose in 1/2 St. Lact. Ring 1000 ml	16452	2 btl					1.21
	Lactated Ringers 500 ml	16373	1 btl					1.29
	Dextrose 10% - Water 500 ml	16365	1 btl					1.25
C-4	Butterfly Inf. Set 25 Ga - Short	16040	6 ea					.69
	Butterfly Inf. Set 25 Ga	16039	6 ea					.58
	Butterfly Infusion Set 19 Ga.	16038	4 ea					.58
	Butterfly Infusion Set 21 Ga.	16568	4 ea					.58
	Butterfly Infusion Set 19 Ga Int	16041	2 ea					.69
	Butterfly Infusion Set 21 Ga. Int.	16570	2 ea					.69
	Venikit - 19 Ga.	16425	4 ea					1.08
	Venikit - 21 Ga.	16426	4 ea					1.08
	Swabs, Preptic	11099-9	1 bx					.78

Nursing Unit W5 E&N Pedi FLOOR CARTS Page 7 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
C-4	Soluset Additive	16910	6 ea					2.09
	Venotube 30 inch	16335	1 ea					.51
	Longdwell Needle 16 Ga.	16178	2 ea					1.00
	Longdwell Needle 18 Ga.	16642	2 ea					1.00
	Longdwell Needle 20 Ga.	16643	2 ea					1.00
	Venoset Microdrip	16329	2 ea					.78
	Surgical Venoset	16331	6 ea					1.25
	Soluset P-100	16252	6 ea					2.14
	Butterfly - 23 Ga	16569	6 ea					.58
	Soluset Additive 250	16910	2					2.82
D-1	Linen Saver, Large	16759	6 pkg					.85
D-2	Pitchers	7219-9	3 ea					.33
	Fracture Pan	7210-8	3 ea					.80
	Urinal	7229-8	3 ea					.39
	Bed Pan	7227-2	3 ea					.65
D-3	Denture Cups	17023-3	4 ea					.03
	Hot, Cup	17027-4	4 bx					.19
	Cold, Cup	17019-1	1 bx					.79
	Salt	7149-8	1 bx					.10
	Ad-Hes-Away	4022-0	1 cn					1.70
	Soda, Baking	4055-0	1 bx					.30

Nursing Unit W5 E&N Pedi FLOOR CARTS Page 8 of 8 Pages

DATE _____

LOCATION	DESCRIPTION	Stock No.	Stock Level	Stock Used	Charge Tickets	Not Charged	Con-taminated	Cost
D-3	Cornstarch	4056-8	1 bx					.26
	Straws, Flex	17065-4	1 bx					1.73
	Cups, Portion	17035-7	1 bx					.48
	Cups, Medicine	17033-2	1 bx					.62
	Glass, Graduated I & O	7079-7	25 ea					.04
D-4	Sterile Exam Gloves	16133	1 bx					6.25
	Unsterile Exam Gloves	16944	1 bx					6.70
	Soap Powder	4061-8	1 bx					.57
	Ajax	4053-5	1 cn					.27
	Phisohex	7126-6	1 gal					4.95

6958-3 1-75 FLOOR CARTS

METHODIST HOSPITAL - LUBBOCK, TEXAS 617710

ORDERED BY

CATALOG #	ITEM DESCRIPTION	QUANTITY	AMOUNT	

FORM NO. 6312-3 (9/74)

CENTRAL SERVICE

DEPARTMENTAL COPY

PATIENT CHARGE TICKET

Enclosure 2

SOURCE: Methodist Hospital, Lubbock, Texas.

APPENDIX E

TIME AND MOTION STUDY OF CART EXCHANGE

TO NINETEEN USING UNITS

APPENDIX E--ENCLOSURE 1

TIME AND MOTION STUDY OF CART EXCHANGE
TO NINETEEN USING UNITS

The study began after the carts had been exchanged and inventoried for the two most difficult areas. This was accomplished by the supervisor of storage and cart exchange. It required 1.10 man-hours. Three clerks were involved with the remainder of the exchange.

Ward	Time Required Minutes	Seconds	Comments
W3W*	12	55	OB Ward *West 3 West (Appendix B, Enclosure 3).
W3E	12	55	
W5E	9	55	Pediatrics
W5N	9	55	Pediatrics
W3N	10	25	
E7	3	05	Regular Cart Most distant in East Wing (Appendix B, Enclosure 2).
E6	5	20	Regular Cart
E5	4	35	Regular Cart
E4	4	25	Regular Cart At this point, four regular carts were inventoried and restocked to complete the exchange. Total time required was 55 minutes, 53 seconds.
E3	4	25	Regular Cart
W7	7	45	CCU
2 Main	5	25	
W8W	7	45	Most distant cart in West Wing

W8E	7	45
2 Central W	5	15
2 Central S	5	15
W8N	7	50
Total manhours to exchange carts		6.13
Total man-hours to inventory and restock reminaing carts		7.50
Time consumed prior to study		1.10
Total man-hours consumed in exchange and inventory of carts for nineteen using units		14.72

APPENDIX E--ENCLOSURE 2

TOTAL CARTS NEEDED FOR MANUAL CART EXCHANGE

Regular Carts:

E7	2	W8	3	3 Central	2
E6	2	W7	2	2 Central	3
E5	2	W6	3	Total	5
E4	2	W4	3		
E3	2	Total	11		
Total	10				

Back-up Carts	11
Subtotal Regular Carts	37

Special Carts

Recovery Room	2
East ICU	2
West ICU	2
West Pediatric	3
L & D Obstetrics	4
West 7 North CCU	1
Operating Room	4
Total	18

Back-up Carts	14
Subtotal Special Carts	32

Grand Total	69

APPENDIX E--ENCLOSURE 3

TOTAL MAN-HOURS REQUIRED FOR MANUAL CART EXCHANGE

26 Regular Carts on Wards
11 Back-up Carts

7 minutes average delivery time
15 minutes average inventory and restock time

9.25 man-hours to inventory and restock
3.05 man-hours to deliver

Subtotal 12.30 man-hours regular carts

18 Special Carts
14 Back-up Carts

7 minutes average delivery time
23 minutes inventory and restock time for 18 carts
20 minutes inventory and restock time for 14 back-up carts (No operating room back-up carts)

11.60 man-hours to inventory and restock
2.17 man-hours to deliver

Subtotal 13.77 man-hours special carts

Total 26.07 man-hours per day

APPENDIX E--ENCLOSURE 4

COST OF EQUIPMENT AND LABOR FOR FIRST YEAR
FOR MANUAL CART-EXCHANGE SYSTEM

Cart Costs:		
69 Carts X $401.20	$27,683	
Estimate of Tray Costs:		
69 Carts X $75	5,175	
Subtotal		$32,858
Wages:		
Supervisor at $3.15 per hour	$ 7,056	
Two full-time clerks at $2.42 per hour	10,842	
Two part-time clerks 24 hours per week at $2.42 per hour	6,505	
Subtotal		24,403
Grand Total		$57,261

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