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Executive Summary

To increase equipment availability and help nurses to better serve patients, we analyzed the current equipment processes within the Patient Equipment and Patient Transportation departments at the University of Michigan Health Systems. The location, ownership, and management of these two departments are currently decentralized. We aimed to determine areas of improvement and to make recommendations for the most efficient way to structure the future equipment processes. These recommendations are intended for the current Children’s and Women’s Hospital, as well as the new hospital that will be opening in 2011.

Literature Search

A literature search was conducted to find previous projects on equipment centralization. This search revealed that current tracking systems within institutions included in the University Health System Consortium’s Tracking Patient Equipment 2005 Benchmarking Project Field Book were not optimal: approximately 48% of equipment requests within these institutions were not being delivered within 30 minutes. Critical factors in making the centralization process successful were identified and include properly trained staff, coordination of tracking within an organization, and appropriate inventory based on demand.

Interviews

We conducted interviews with nursing and clerical staff which revealed an overall perception that Patient Equipment functions at a satisfactory level while Patient Transportation does not. From the 12 interviews conducted, all stated that 50% of equipment delivered by Patient Equipment were delivered within one hour while less than 25% for Patient Transportation. Next, both departments were shadowed to gain a better understanding of the processes to develop flow charts.

Data Analysis and Recommendations

The Patient Transportation department provided the data from March 1, 2006 to March 14, 2006 for the entire hospital. This data included the time it took for deliveries, type of equipment requested, and day of the week it was delivered.

Our analysis revealed that 13% of requests were not being delivered within the 30 minute standard. This percentage considers data for the entire hospital. However, from our observations, we determined this data to also be representative of Mott deliveries. To evaluate the cause of these delays, the type of equipment and day of the week were analyzed by a one sample t-test. The type of equipment and the day of the week were
found to have no significant effect on the delivery time with p-values of 0.59 and 0.17 respectively.

It is recommended that Patient Transportation only be responsible for the transportation of patients within the hospital. Patient Equipment would be responsible for delivering the equipment that is currently delivered by Patient Transportation in addition to the equipment that they have. The two departments have similar tasks as they both deliver equipment. In order to maximize efficiency it is best to group the departments so that one will deliver equipment and the other transports patients. This will reduce overall processing and procedures.

Next a pilot study was conducted within Patient Equipment to finalize data collection forms and the breakdown of tasks. Data were collected in Patient Equipment over 57 hours across all days of the week (including both morning and afternoon shifts). After analysis, we found that currently 47% of orders are not delivered within 30 minutes, and that delivery times can take up to 57 minutes. The tasks included in the process were broken down to determine which was accounting for this delay. It was found that the request-to-print task comprises exactly 50% of the total cycle time. The day of the week was found to be a significant factor because statistical analysis revealed a p-value of 0.04. The shift was also found to be a significant factor due to a p-value of 0.04 using an f-test. It is expected that both the day of the week and the shift would affect this task as some days and times have a higher volume of patients and therefore a higher volume of equipment needed.

Due to the long time it takes for the email request to be printed (up to 55 minutes), we propose that a pager system be installed that will immediately tell the attendant that an order has been placed. In addition, a scanner would be integrated into the pager system. This would allow for the attendant to clean and charge orders without returning to the Patient Equipment room. This system would only page orders that were for Mott, not for University Hospital, and would eliminate the need for a computer in the Mott Patient Equipment office. Implementation of this system would save an average of 16 minutes plus travel time for each request. On average, 13 orders are placed between 7 am and midnight. Therefore 1265 hours per year could be saved during this time frame by implementing this system.

We also found that from 7 to 9 AM, the time between requesting and printing an order was 18 minutes longer than the daily average. From our observations, we determined the cause to be the shift change, not the volume of orders at this time. It is recommended that all shifts clear more discharged equipment from the floors before the next shift begins and that every two hours a sweep is conducted. By implementing standard sweep times, more equipment will be available for delivery and this will allow the next shift to focus on deliveries rather than equipment pickup. Patient Equipment attendants should not leave the office until the next attendant has arrived for their shift. This will reduce the amount of time that orders are waiting to be delivered.
The type of equipment that was requested most frequently was the Aleris Pump. It accounted for 39% of all orders. Therefore, we propose some rooms in the new Children's and Women's Hospital be equipped with a Single Aleris Pump. This would save the Patient Equipment department an average of 26 minutes per Aleris Pump for each new patient (208 days per year based on 11,519 patients admitted in 2004). It is proposed that Environmental Services clean the Aleris Pumps when a patient is discharged while they clean the rest of the room. This would add approximately 30 seconds per pump which equates to 4 days per year.
Introduction

To better serve patients through acceleration in equipment delivery, the University of Michigan Children’s and Women’s Hospital is going to centralize equipment in the new hospital which is planned to open in 2011. Currently, the equipment for the Children’s and Women’s Hospital is decentralized in location, ownership and process management. This system creates long delivery times and equipment accumulation in nursing units, hallways and soiled holding rooms. Therefore, the purpose of this project was to analyze the current process in the Children’s and Women’s Hospital to determine areas of improvement and to make recommendations for the most efficient way to structure the future equipment process to ensure that equipment is readily available for nurses. This document reports findings from observations, interviews, data collections in addition to conclusions and final recommendations for this equipment process.

Background

Currently, equipment for the Children’s and Women’s Hospital is stored as follows:

- Patient Equipment Department manages 4,354 pieces of equipment including dialysis machines, IV infusion pumps, and other reusable electronic patient equipment
- Patient Transportation Department manages equipment including beds, stretchers and wheelchairs
- Nursing Unit storage holds their specific unit-owned equipment (games, “bouncy chairs,” toys, etc.)
- Hallway alcoves may be used to store excess equipment that is ready to use
- Soiled Rooms contain used equipment waiting for pickup and decontamination

The centralization of equipment for the future Children’s and Women’s Hospital will be done through a “Central Garage.” The Central Garage will be approximately 3,500 square feet and will include equipment currently stored in Patient Equipment, Patient Transportation, and the unit-owned equipment. The unit storage that currently exists in the Children’s and Women’s Hospital will be eliminated in the future hospital.

We analyzed the current equipment process in order to recommend improvement opportunities. Within the current process, we also identified methods to determine the most efficient equipment management process for the future Central Garage.
Project Scope

The project analysis included:
- Storage, delivery, pickup, and decontamination of equipment belonging to the Patient Equipment and the Patient Transportation departments

The project analysis excluded:
- Transportation of patients
- Transportation of medical supplies (i.e. linens, medication, and food)
- Storage of office furniture and supplies currently in nursing unit storage areas
- Improvement of existing and future Central Garage layout and location

Key Issues

We investigated the following key issues:
- Increase in service scope of equipment delivery and retrieval in the future Children’s and Women’s Hospital
- Delays in current equipment delivery process
- Size of available space to store current inventory
- Clutter of equipment in hallways
- Difficulty retrieving equipment due to size of the new Central Garage

Goals and Objectives

The goals and objectives of this project were:
- Making equipment available for nurses (patients)
- Analyzing the current process of equipment retrieval, delivery, tracking, decontamination, and storage at the Patient Equipment Department, Patient Transportation Department and the nursing units
- Eliminating non-value added steps in the equipment process
• Identifying areas of opportunity within the current system that will aid in the transition to the future Children’s and Women’s Hospital

• Recommending the most efficient way to organize the space and processes of retrieving and storing equipment at the Central Garage

• Recommending the most effective management structure of equipment in the future Central Garage

• Determining the appropriateness of meeting a 30-minute delivery standard

**Project Methodology**

We first conducted a literature search to investigate centralization processes in hospitals worldwide as well as the level of satisfaction of their stakeholders. Concurrently, we interviewed key nurses and clerk to estimate their level of satisfaction with the current equipment processing system. We then observed the current equipment processes within both the Patient Equipment and Patient Transportation departments to get accustomed with the process of delivering and retrieving equipment. At this time, flow charts of the current processes were made.

We next conducted a pilot study to develop and refine our data collection method for the Patient Equipment department. We then collected data in Patient Equipment over a period of three weeks, measuring each Morning and Afternoon shift for 3 hours. The data collection for the Patient Equipment department was conducted using the forms found in Appendix A. These forms allowed us to determine the amount of time that each step of the process takes. Over a period of three weeks (from 2/27/06 to 3/24/06), each member of our team individually shadowed an attendant for a shift of three hours. Total data collection included 19 morning/afternoon shifts throughout the week for 57 hours.

For Patient Transportation, data that was compiled from their department was used for all hospital requests 24 hours per day for two weeks in March.
Literature Search

We reviewed surveys that were included in UHC’s Tracking Patient Equipment 2005 Benchmarking Project Field Book. They investigated the operations and the nurse satisfaction in 31 hospitals nationwide. The results are presented in Table 1 and 2.

<table>
<thead>
<tr>
<th>Table 1: Operations Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
</tr>
<tr>
<td>Equipment tracking is used</td>
</tr>
<tr>
<td>Bar-coded tracking system is used</td>
</tr>
<tr>
<td>&gt;90% of equipment can be readily accounted for at any time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Nursing Survey Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
</tr>
<tr>
<td>Typical turnaround time between ordering and receiving infusion pump is 30 minutes or less</td>
</tr>
<tr>
<td>Nursing Staff is very satisfied with equipment management and availability</td>
</tr>
<tr>
<td>Little/no hoarding of equipment in Institution</td>
</tr>
</tbody>
</table>

These two surveys revealed that the current systems for tracking and delivering equipment in hospitals nationwide are not optimal. There are great opportunities for improvement.

Furthermore, the UHC’s Tracking Patient Equipment 2005 Benchmarking Project Field Book lists factors that are critical to successfully centralize equipment. These factors include:

- Equipment tracking should be coordinated within organization
- Accurate and current data are necessary to determine equipment demand for the organization
- Equipment monitoring data should be used to improve performance
- Maintenance should be integrated within equipment distribution
- Staff should be properly trained and held accountable
Interviews

We interviewed eight nurses, two unit hosts and two clerical staff members from Holden Neonatal Intensive Care, Mott Operating Room, and two general care units. Table 3 summarizes the responses to key interview questions. The interviews indicated a general satisfaction with Patient Equipment and their timeliness to deliver equipment; however, Patient Transportation is not delivering equipment in a timely manner.

Table 3. Nursing and Clerical Staff Responses to Interview Questions

<table>
<thead>
<tr>
<th>Key Questions</th>
<th>Patient Transportation</th>
<th>Patient Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How well does the process of equipment delivery work?</td>
<td>Not well</td>
<td>Pretty well</td>
</tr>
<tr>
<td>2. In what time frame is equipment delivered from time of request?</td>
<td>One hour to all day</td>
<td>Within an hour</td>
</tr>
<tr>
<td>3. What % of time are orders received within 30 minutes?</td>
<td>&lt; 25%</td>
<td>50%</td>
</tr>
</tbody>
</table>

A more extensive list of interview questions and responses are given in Appendix B.

Flow Charts

Using team observations, we developed flow charts that map the current processes used by Patient Equipment and Patient Transportation. We divided the process into individual steps for time data collection analysis. The flowcharts for Patient Equipment and Patient Transportation Departments appear in Figures 1 and 2, respectively. Each flowchart follows the equipment process from initial request from the nurse/clin, to delivery to clerks desk or patient room and then to patient, and indicates the exchange of requests and equipment between employees.
Figure 1. Patient Equipment Flowchart: Current Process
Figure 2. Patient Transportation Flowchart: Current Process
Alternatives and Hypotheses Considered

To ensure equipment availability for nurses (patients), we analyzed sources of delay in the equipment delivery process. Table 4 summarizes the delays identified from the flow charts and observations which helped with the analysis of the above hypotheses.

<table>
<thead>
<tr>
<th>Table 4: Possible Sources of Delay in Departments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Equipment</strong></td>
</tr>
<tr>
<td>Time consuming tasks</td>
</tr>
<tr>
<td>Time consuming equipment preparation (including locating time)</td>
</tr>
<tr>
<td>Shift or time of day</td>
</tr>
<tr>
<td>Day of the week</td>
</tr>
<tr>
<td>Delivery location</td>
</tr>
</tbody>
</table>

Patient Equipment Findings and Conclusions

Interviews with nursing, unit hosts and clerical staff revealed a perception that only 50% of orders were delivered in less than one hour. They expressed concern with this delay. The current state of the process was analyzed further to follow up these concerns.

Current State

As a result of these findings, the perceived delay was investigated through determining the current state of the system. A defect in this system is defined as a total cycle time (time from request to delivery) greater than 30 minutes. The current state was evaluated and 47% of orders are not delivered within 30 minutes. This was consistent with what UHC found in their study of 31 hospitals (48%).

The following were identified as possible factors affecting the time of each task.

- Type of equipment
- Shift (Morning and Afternoon)
- Delivery location
- Day of the week
Equipment

A list of the equipment that was ordered and delivered during data collection is summarized in Table 5.

Table 5. Amount of Equipment Ordered During Data Collection

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aleris Single Pump</td>
<td>79</td>
</tr>
<tr>
<td>Syringe Pump</td>
<td>47</td>
</tr>
<tr>
<td>Medfusion Syringe Pump</td>
<td>19</td>
</tr>
<tr>
<td>Kangaroo Feeding Pump</td>
<td>15</td>
</tr>
<tr>
<td>Double Aleris Pump</td>
<td>14</td>
</tr>
<tr>
<td>CR Monitor</td>
<td>9</td>
</tr>
<tr>
<td>PCA Pump</td>
<td>3</td>
</tr>
<tr>
<td>Pace Maker</td>
<td>3</td>
</tr>
<tr>
<td>Flowtron C. Device</td>
<td>3</td>
</tr>
<tr>
<td>Wedge Frame</td>
<td>2</td>
</tr>
<tr>
<td>Gaymar T-Pad</td>
<td>2</td>
</tr>
<tr>
<td>ICP Monitor</td>
<td>1</td>
</tr>
<tr>
<td>Warmflow Blood</td>
<td>1</td>
</tr>
<tr>
<td>Omni Flow</td>
<td>1</td>
</tr>
</tbody>
</table>

A chart of the quantity of equipment ordered during our data collection is displayed in Figure 3. This shows that 79 Aleris Pumps were ordered, accounting for 39.7% of all orders. The Syringe Pump accounts for 23.6% of the orders. Therefore, the Aleris Pump is the most requested type of equipment.

Figure 3: Pareto Chart Indicating Percentage of Equipment Ordered
Analysis of Total Cycle Time

Total cycle time is defined as the time the request was sent to the time that the order was delivered. Data analysis results show that out of the 117 runs observed, the average delay between the time an email request is sent and the time the equipment is delivered was 30.1 minutes. This meets the 30 minute standard. However, the maximum times vary substantially and in some cases have been found to be as long as 57 minutes. A graphical representation of this data is shown in Figure 4.

![Boxplot Total Cycle Time From Email Request to Delivery](image)

Figure 4 also displays the 30 minute standard compared to the mean of 30.1 minutes. A line is drawn at 30 minutes to show the standard to which the data is being compared. It can be seen that the average total cycle time is meeting the 30 minute standard with 47% of all orders. The total cycle time is further analyzed.

Analysis of Task Breakdown

The total cycle process can be broken down into four tasks:
- Task 1: Email to print
- Task 2: Print to retrieval
- Task 3: Retrieval to departure
- Task 4: Departure to delivery
Table 6 summarizes the descriptive statistics for the time between the email being sent, printed, and retrieved, departure, and delivery.

Table 6. Descriptive Statistics of Each Task of the Total Cycle

<table>
<thead>
<tr>
<th>Tasks</th>
<th>N</th>
<th>Average (min)</th>
<th>Standard Deviation (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Email Sent &amp; Print</td>
<td>117</td>
<td>16.1</td>
<td>12.5</td>
</tr>
<tr>
<td>2. Print &amp; Retrieve</td>
<td>117</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>3. Retrieve &amp; Depart</td>
<td>117</td>
<td>5.6</td>
<td>7.0</td>
</tr>
<tr>
<td>4. Depart &amp; Deliver</td>
<td>117</td>
<td>5</td>
<td>6.0</td>
</tr>
</tbody>
</table>

The sum of the task averages is 32.2 minutes (shown in Table 6 and Figure 5) which is greater than the delivery time average of 30.1 minutes. These times are not equal due to the variance within each task. The breakdowns of the process were analyzed to determine the task or tasks taking the most amount of time and causing the variance within the process. To evaluate which task within the current process accounted for most of the time, a chart of task times was made.

Figure 5. Task Breakdown of Total Cycle Time
Figure 5 shows that the time between requests being sent and printed accounts for 50% of process time while the other three tasks are evenly distributed over the other 50%. Furthermore, the means and variability within the different tasks is shown in Figure 6.

Figure 6. Comparison of Average Time and Variance of Each Task

Figure 6 also shows that the task with the highest mean time and most variability is between the time that the email request was sent by the clerk and printed by the Patient Equipment attendant. This supports the findings from the pareto analysis. The mean time for the email sent to print task was 16.1 minutes and the standard deviation was found to be 12.5 minutes. The other three activities above have low mean times and low variability; therefore, these tasks will not be further analyzed.

Analysis of Request to Print Time

The request to print time (Task 1) was further analyzed to determine if the shift or day of the week had an affect on it. The other two factors previously identified are not investigated because task 1 can not be affected by type of equipment or the delivery location (due to the task type). An analysis of variance was conducted for the day of the week revealing a p-value of 0.04 and R-squared value of 69.1%. The shift p-value was found to be 0.04 by an f-test. Thus, the day of the week and shift are significant factors.
Furthermore, each hour of the day was analyzed to determine what if time of day has an impact on how long a request will wait before being printed. Figure 7 below shows the average time an email request waits before being printed by the Patient Equipment attendant, depending what time the email request is sent by the clerk starting at 7 am.

![Figure 7. Average Time Between Email Sent & Print Tasks](image)

Figure 7 shows that requests wait, on average, longer than 30 minutes to be printed by the Patient Equipment attendant when it is sent between 7-9 am. The average wait time before printing is 34 minutes between 7-8am, and 31 minutes between 8-9am. This is approximately 18 minutes longer than the average time per day across all times. The average time over the whole day is 14 minutes. Note that no requests were observed at 3 pm or at 10 pm.

Analysis of Outliers

To further investigate the cause of the long wait from 7-9 am, the number of requests per hour was analyzed. Figure 8 shows the average number of requests placed within each hour.
Figure 8 shows that the hour receiving the most requests is from 5-6 pm (averaging 2.0 requests within that time), not from 7-9 am, which averages less than one request within that time observed. Therefore, the long printing delay in Figure 7 cannot be explained by an overload of requests from 7-9 am and is not caused by the Patient Equipment attendant delivering equipment.

From observations, Patient Equipment attendants generally spend the first two hours of the morning shift (7-9 am) picking up soiled equipment from Mott that was not retrieved during the night. Also, all soiled equipment returned to Patient Equipment must also be decontaminated. Both the pickup and decontamination processes keep the PE attendant away from the computer where email requests arrive. It was also observed that from 7 to 8 am there was a gap between when one attendant leaves and the next arrives between shifts. It is the time spent in these tasks that is causing the large print delay from 7-9 am.
Analysis of Soiled Room

The soiled room task is broken into two tasks shown in Table 7.

<table>
<thead>
<tr>
<th>Task</th>
<th>Average Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter soiled room to exit soiled room</td>
<td>3.3</td>
</tr>
<tr>
<td>Exit soiled room to return to Patient Equipment office</td>
<td>9.7</td>
</tr>
</tbody>
</table>

The total soiled room cycle time was averaged to be 12 minutes which does not equal the sum of the task averages due the variance within each task. Figure 9 shows each task average time and their sum.

Figure 9 shows that more time is spent traveling from the soiled room to the Patient Equipment department than inside the soiled room taking care of equipment. From observation, this can be attributed to the fact that many soiled rooms were checked in a row before the attendant returned to the Patient Equipment department.
Patient Transportation Findings and Conclusions

Concern was expressed in interviews with unit hosts, nurses and clerical staff that Patient Transportation was not delivering orders in a timely manner. It was their perception that no orders were delivered within a half hour, and at times it could take up to all day to have a piece of equipment delivered. The current state of the process was analyzed further to follow up these concerns.

Current State

After analysis, we found that only 13% of orders were not being delivered within the 30 minute standard. This varied greatly from the perception of the unit hosts, nursing and clerical staff. A total of 6,187 pieces of equipment were delivered from March 1, 2006 to March 14, 2006. The average total cycle time found was 19.73 minutes with a standard deviation of 11.84. This is shown in Figure 10.

![Figure 10. Delivery Times for Patient Transportation (N=6187)](image)

The outliers having cycle times of 339 and 341 minutes are not shown in the above histogram. From Figure 10, it can be seen that most orders are delivered within the 30 minute standard and the average cycle time is approximately 10 minutes below that standard.
Factors contributing to orders not being delivered within 30 minutes may include: type of equipment and day of the week. Therefore, we further investigated these two factors with statistical analysis.

Analysis of Equipment

Table 8 outlines the type and number of equipment ordered from the collected data. It can be seen that wheelchairs account for 4,132 of the 6,187 pieces of equipment ordered during data collection.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair</td>
<td>4,132</td>
</tr>
<tr>
<td>Regular Stretcher</td>
<td>1,656</td>
</tr>
<tr>
<td>Bed</td>
<td>218</td>
</tr>
<tr>
<td>Stroller</td>
<td>61</td>
</tr>
<tr>
<td>Crib</td>
<td>52</td>
</tr>
<tr>
<td>Bed ICU</td>
<td>40</td>
</tr>
<tr>
<td>Bubble Top</td>
<td>13</td>
</tr>
<tr>
<td>Banana Cart</td>
<td>10</td>
</tr>
<tr>
<td>Bassinet</td>
<td>2</td>
</tr>
<tr>
<td>Double Wide Wheel Chair</td>
<td>2</td>
</tr>
<tr>
<td>Isolette</td>
<td>1</td>
</tr>
</tbody>
</table>

This is also represented in Figure 11 which shows the percentage of total equipment ordered.
From Table 8 and Figure 11, it is apparent that wheelchairs are ordered most. 4132 wheelchairs were ordered, accounting for 67% of all requests. Stretchers have the next highest demand. Stretcher orders accounted for 27% of all requests. Figure 12 compares the average delivery times for each type of equipment.
Figure 12. Average Delivery Time by Equipment

Figure 12 reveals that the average delivery time for the Isolate was 48 minutes. This is much longer than the average delivery time for all other types of equipment (below 26 minutes).

Our data collection showed that only one isolette was requested. The isolate had the smallest number of requests, but also took the longest to deliver. From observations it is known that in a given storage space, a variety of Patient Transportation equipment is stored together. The isolettes were observed to be kept in the back of a storage room behind other equipment (i.e. stretchers). Moving the other equipment was necessary to retrieve an isolette from the room. It is possible that the isolettes are pushed to the back of the storage room because they are not requested often, making them difficult and time-consuming to retrieve.

An analysis of variance was conducted for the equipment to determine if the above findings were statistically valid. The results of the ANOVA revealed a p-value of 0.17. Thus, the type of equipment to deliver is not a significant factor and does not affect the delivery time.

Analysis of Day of the Week

First, the volume of requests per day was compared. Figure 13 shows the total number of requests made on each day of the week over the two-week period of data collection.
Figure 13. Number of Equipment Requests by Day of Week

Figure 13 shows there were over 500 requests made on each weekday over the two-week period, while the weekend days experienced significantly fewer requests. Next, we analyzed the delivery times for each day of the week to see if the days of the week had a significant effect on delivery times. Average delivery times are shown in Figure 14.
An analysis of variance was conducted for the day of the week revealing a p-value of 0.59. Thus, the day of the week is not a significant factor and does not affect the delivery time. From this, we can also infer that, although the volume of requests is much higher on the weekdays than the weekends, the average delivery time is not affected by the volume of requests received. In other words, delivery times of over 30 minutes are generally not caused by a high volume of requests.

**Recommendations and Implementations**

Our analysis of current materials process has revealed several areas that could be improved to increase equipment availability to nurses and patients, and make the equipment process more efficient. This will also increase patient satisfaction and worker productivity, and the reputation of UMHS. The following are recommended improvements to the system.

**Management**

We recommend that both departments continue to operate and manage as separate departments. Expanding on Patient Transportation’s dispatcher concept, having a paging system for both departments will help reduce the percentage of orders not delivered within the standard to an acceptable level.

**Patient Transportation**

It is recommended that Patient Transportation only be responsible for the transportation of patients within the hospital. Patient Equipment would be responsible for delivering the equipment that is currently delivered by Patient Transportation. The two departments have similar tasks as they both deliver equipment. In order to maximize efficiency it is best for one department to deliver equipment and one to transport patients to reduce overall processing and procedures. This merge is assumed throughout our recommendations.

**Patient Equipment**

*Equipment*

In our analysis, we found that the Aleris Single Pump had the highest volume of requests (accounting for 39% of all requests observed). Because of the high request volume, we recommend that some rooms be equipped with one Aleris Single Pump. From further analysis, the departments that frequently use Aleris Pumps will be supplied with one
pump per bed. This will minimize the number of new Aleris Pumps that need to be purchased. Using this approach, some patients have immediate access to one Aleris single Pump attached to a pole; the requests to Patient Equipment department then are reduced. This can be implemented now and once the future Central Garage is open. During room decontamination, it is recommended that the pump and pole will be cleaned by Environmental Services. Permission to pass this responsibility must be obtained from Environmental Services. The task involves spraying the items with disinfectant and wiping them with a cloth; the task time is approximately 30 seconds per pump for each discharged patient, or 4 days per year based on 11,519 patients admitted to Mott in 2004. In contrast, Patient Equipment attendants could save up to 26 minutes per Aleris Pump that is left in the room per new patient. This is equivalent to 208 days per year saved based on 11,519 patients admitted to Mott in 2004. This time saved accounts for the time between a pump being requested and the order being printed and also the travel time.

Process Delay

Our analysis also showed that the main source of delay is between the time a request is sent by the clerk and printed by the Patient Equipment attendant. To reduce the variance in this task, we recommend replacing the current email request system with an automatic request system (i.e. pager system) so that the attendant receives the request immediately without having to be at the computer. The paging system will also have an integrated scanner which allows the attendant to issue and charge the equipment without returning to their office.

The Environmental Services department currently uses an automatic paging system called Teletracking. It operates as follows. When a patient is discharged, the patient brings a card to the clerk notifying them they’re leaving. The clerk then enters a code into the computer resulting in a custodian being paged with the room number to be cleaned. The custodian enters a code into a phone; this code alerts the system that he is cleaning the room. Upon completion of the job, the custodian enters another code via phone to alert the system that he is finished. Using this system, management regularly reviews performance of the custodians using average job times.

We recommend to install a system similar to Teletracking, but with several differences. We want a system that:

- Automatically pages the Patient Equipment attendant when a request for equipment is made by a clerk describing what equipment is needed and where it must go
  - The clerk could enter the order into the computer or use a simple paging system.
  - The automatic page removes the waiting time before the attendant realizes that there is a new order to complete

- Allows the attendant to charge and discharge equipment in places other than the Patient Equipment office
We recommend that the attendant be equipped with a hand-held scanner for this purpose. Depending on available technology, this scanner could be an independent device, as is currently used in the Patient Equipment department, or could be on the same device as the pager. The ability to scan would eliminate the time an attendant spends issuing/charging and returning an item via data entry on the computer and would remove extra processing due to the paper for charging.

- Measures job completion time
  - If the attendant can issue/charge a piece of equipment anywhere, the attendant should issue/charge the piece of equipment upon arrival to the clerk’s desk; the job time is then the difference between equipment request and the time it is issued/charged.

Upon discussing the system with Environmental Services management, installation is expected to take approximately 10 months and will not interrupt the ability of employees to work in the current system. After implementation and training of the system within Environment Services, average job time went from 1.5 hours to 40 minutes. In Patient Equipment it is expected that incorporation of this system will save an average of 16 minutes that is currently delayed before an email is printed for each order. On average, 13 orders are placed between 7 am and midnight. Therefore 1,265 hours per year could be saved during this time frame by implementing this system. In addition, this can save travel time if they are close to the delivery location when a request is received. Freeing up this time will allow for all pieces of equipment to be delivered in a timelier manner which would increase nursing and clerical staff satisfaction due to patient satisfaction.

Request Filter

To reduce time and chance for error, the Mott Patient Equipment department should only receive requests for Mott delivery locations. To achieve this reduction, the automatic paging system will be installed so that only orders for Mott departments will signal the Mott attendant. This could reduce the number of errors and the amount of time spent searching for Mott requests. The hospital’s webmaster or a software consultant would configure these settings.

Shift Change

Our analysis of time between email sent and print was 18 minutes longer between 7 and 9 am than the hourly average. We observed that at this time, there was a minimum of 30 minutes between one attendant leaving and the next arriving between shifts. After arrival, the attendant would then focus on retrieval and decontamination of soiled equipment that was not retrieved during the night. These tasks take time away from delivering requests. To solve this, we want to provide the Patient Equipment attendant with better equipment availability and more time to focus on making deliveries. Therefore, we recommend that
no attendant can leave until the next arrives in the Patient Equipment office for the following shift. We also recommend that management specifically schedules and directs all attendants to check all soiled rooms every two hours. This is based on the finding that approximately 11 pieces of equipment are picked up every two hours. This task will fall secondary only to delivering equipment orders and will not leave the next shift with an abundance of soiled equipment. While sweeping, the attendant can still receive pages for equipment requests.
References


APPENDIX
# Appendix A: Data Collection Forms

## PATIENT EQUIPMENT

<table>
<thead>
<tr>
<th>Request #</th>
<th>Run Time</th>
<th>Equipment</th>
<th>Quantity</th>
<th>STAT</th>
<th>Storage Location</th>
<th>Is Ready</th>
<th># Orders</th>
<th>Waiting</th>
</tr>
</thead>
</table>

Date: 

Observed By: 

---

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# PATIENT EQUIPMENT

## Run Time Breakdown (Run _____)

### Delivery (times)

<table>
<thead>
<tr>
<th>Request Email Sent</th>
<th>Check Email and Print</th>
<th>Retrieve Order / Prep</th>
<th>Enter Order</th>
<th>PE Departure</th>
<th>Order Delivered</th>
<th>Return</th>
<th>Delivery Location</th>
</tr>
</thead>
</table>

### Retrieval

<table>
<thead>
<tr>
<th>Soiled Room</th>
<th># Equip. Returned</th>
<th>Equipment Type</th>
<th>Time Enter Room</th>
<th>Time Exit Room</th>
<th>Decontamination</th>
<th>Scan / Discharge</th>
<th>Return</th>
</tr>
</thead>
</table>

---

Date: __________________
Observed By: __________________
**Appendix B: Interview Questions and Responses**

<table>
<thead>
<tr>
<th>Interview Questions</th>
<th>General Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Equipment</strong></td>
<td><strong>Patient Transportation</strong></td>
</tr>
<tr>
<td>1. How is equipment requested?</td>
<td>PE Website via Clerk</td>
</tr>
<tr>
<td>a. How well does this system work?</td>
<td>Fairly Well</td>
</tr>
<tr>
<td>b. In what time frame does this happen?</td>
<td>Usually within an hour</td>
</tr>
<tr>
<td>2. What % of time would you say you receive orders within 30 minutes?</td>
<td>50%</td>
</tr>
<tr>
<td>a. Does anything ever go wrong in the process? How Often?</td>
<td>Wrong cables, not frequent</td>
</tr>
<tr>
<td>b. Is there a particular piece of equipment that seems to be less available than the others?</td>
<td>Infusion Pumps, Monitors</td>
</tr>
<tr>
<td>c. Is there a certain time of the day that seems to be worse? Day of the week?</td>
<td>Afternoons, shift change / Weekends</td>
</tr>
<tr>
<td>d. How are STAT orders treated differently than regular orders?</td>
<td>No difference**</td>
</tr>
<tr>
<td>e. How much quicker do they come?</td>
<td>Not much **</td>
</tr>
<tr>
<td>3. Do you always know exactly where to pick up equipment when it comes for you?</td>
<td>Clerk desk</td>
</tr>
<tr>
<td>a. Is there ever a mix up in the order? How often does this occur?</td>
<td>Not usually</td>
</tr>
<tr>
<td>4. What is the process of retrieving equipment from your unit storage room?</td>
<td>Nurses retrieve</td>
</tr>
<tr>
<td>a. How much time does it take to retrieve an item from your unit storage room?</td>
<td>Survey room to locate and move other equipment if necessary</td>
</tr>
</tbody>
</table>

**The Neonatal Intensive Care Unit clerical staff always order equipment STAT.**