University of Michigan Hospitals and Health Centers  
UMHHC

Analysis of Inventory and Maintenance of  
Cardio Monitor Cables

Final Report

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Executive Summary

This project is a detailed account of our team’s analysis of the current cable management process at the University of Michigan Hospitals and Health Centers (UMHHC), our evaluation of potential alternatives, and our recommendations for the improvement of the current process. The Director of Materiel Services at UMHHC would like to know how to increase the efficiency of the current process so that cables are properly managed. The following key issues were driving the need for this project: lost and misplaced cardiac monitor cables, excessive time wasted looking for lost cables, nurse dissatisfaction with the current process, and patient safety.

Background
The current idealized cable management process at UMHHC to transfer a patient from one unit to another is as follows:

1) The “brain” (a unit that connects to the cardiac monitor and stores patient information) is removed from the fixed monitor and placed into the portable cardiac monitor, while leaving the cables attached to the patient and brain. (Patient is transferred with brain and cables only if necessary; otherwise, the patient is transferred with only leads attached.)
2) The patient is moved to the next unit accompanied by a nurse from the sending unit and a transporter.
3) The patient is attached to the fixed monitor in the new unit.
4) The nurse from the sending unit obtains a brain with cables from the destination unit and returns it to the previous unit.

There are many problems with the operation of the current process. The main issue with the current process is the improper exchange of cables at the receiving unit. This occurs because the receiving unit does not have a set of exchange cables on hand. Another significant problem with the current process is that the different departments in the hospital do not follow the process in a standardized fashion.

Methodology
The methods of this project consisted of the following tasks.

Literature Search: The project began with an extensive literature search to find any previous research done in this area.

Interviews and Process Observation: To gain a deeper understanding of the cable management process and its corresponding issues our team interviewed key hospital personnel in person, over the phone, and via email. Our questions focused on current processes, apparent problems, possible solutions, and relevant inventory and purchase data. In order to corroborate much of the information that was gathered in the interviews, the team also observed the cable management process from its own point of view.

University HealthSystem Consortium (UHC) Data: The next phase of the project assessed the UHC survey data results. The purpose of the survey was to assess the extent of the cable management issues at other University health systems and also to determine the differences in the respective cable management processes.
**Inventory:** The team conducted an inventory of cardiac monitors throughout the University hospital to determine the units of the hospital that use the most cables and thus, are affected the most by the cable management problems.

**Purchase Report Data:** Purchase report data was collected to determine the cost associated with lost cables at UMHHC. The data also allowed the team to determine which departments were affected the most by problems with the cable management process.

**Flow Chart Analysis:** Throughout the project, our team has maintained a detailed flow chart for the current cable management process as it actually works, a flowchart of the current idealized process, and a flowchart of the proposed new process.

**Nurse Survey:** The final phase of our methods consisted of a survey sent out to nurses in various units. The survey results were important for the following reasons:
1) Assess the awareness of the current cable management process in place
2) Determine the frequency of lost cables
3) Quantify the amount of time spent looking for lost cables
4) Determine how many nurses follow the current process
5) Allow for feedback on our team’s potential solution

**Findings**
The literature search and UHC data yielded information regarding the cable management processes of various hospitals across the country. The team discovered that many of these hospital’s cable management processes are similar to UMHHC and that these hospitals experience similar problems. Also, the team learned that many hospitals do not even transport patients with cardiac monitors. Finally, the team discovered a number of solutions that were implemented at various institutions. Some of these solutions include:
1) “Cord caddies,” which are used to hang cables on the wall in plain sight
2) “Spiral wrap product,” which is used to wrap important cables together into a larger bundle that is harder to misplace

Through the interviews and process observation conducted, our team gained a full understanding of the current process and its problems. The process, as was described in the background, is not followed in a standard fashion across all units. Often, patients are transferred without attached cables and exchange cables are not provided by the receiving unit for the sending unit upon transfer.

The current inventory of cardiac monitors at the hospital is 1151, which should correspond to cardiac cable inventory. The team found that between November 2006 and October 2007, there were 198 cables ordered. This represents nearly 20% of all of the cardiac monitors in UMHHC and this cost the hospital $19,340.07. The team discovered the following important results in its survey of 32 nurses:
1) 42% of nurses strongly agree that there is a problem with the current process
2) 28% of nurses did not know that there is supposed to be a standardized process
3) 43% of nurses search for cables on a daily basis
4) On average, a nurse spends 24 minutes per day searching for lost cables

**Recommendations**
In making our ultimate recommendations, the team has assessed the benefits of a new process on different levels: cost savings from the decrease in loss of cables, increased patient safety from the new process, and implementation cost to UMHHC.

**New Process**
The team recommends a new cable management process that consists of the following necessary elements:

1) Cables should be attached to the brain and possibly fastened
2) A patient will always be transferred with the brain and all necessary cables attached, regardless of the unit of origination
3) At least one nurse from the sending unit will accommodate the patient from the sending unit to the receiving unit
4) The sending unit nurse is solely responsible for receiving a replacement brain and cables from the receiving unit
5) The receiving unit must have a replacement brain and cables on hand before the nurse from the sending unit arrives with the patient
6) A log of the transaction between the sending and receiving unit will be kept by each individual unit to document the improper exchange of brain and cables

**Additional Recommendations**
A key additional recommendation is that the three main cables associated with the brain must be attached. “Attached” in this instance does not mean that the cables must be fastened to the brain, but it is essential that the cables are treated as such. Thus, in treating the cables as part of the brain, it is much less likely that cables will in fact be lost. Another additional recommendation is to tie the three cords that are always used with the brain together. This will also help to eliminate the loss of the cables because they will be attached in a bundle much larger than each individual cable. Also, cables should always be in plain view on top of counters or potentially hanging from hooks attached to the wall. This is yet another method that will minimize the loss and misplacement of cables. Finally, the implementation of new cable process must also be accompanied by a written policy in order to standardize the process across all units.

**Benefits**
The implementation of the new cable management process will positively affect the University Health System in a number of ways including: cost savings, nurse efficiency, and nurse satisfaction. The implementation will save the University approximately $17,000 per year (including a deduction for damaged, as opposed to lost, cables). With the implementation of the team’s recommendations the nurses will eliminate the 24 minutes per week spent looking for lost cables. The reduction in this wasted time will, in turn, increase the efficiency and utilization of the nurses. Finally, the frustration that many nurses have complained of will be alleviated with the new cable management process. The implementation cost of the new cable management process will be non-monetary and will require only time and effort on the part of key personnel.
Introduction
Many patients within University of Michigan Hospitals and Health Centers (UMHHC) require cardiac monitors. When patients are transferred from one unit to another, they are connected to either a fixed or portable heart monitor via cables. These cables are often lost, because they are in constant use and their location often changes. Since the cables are transferred across departments and groups, the hospital is facing questions regarding cable ownership and problems in budgeting and managing their purchase. Therefore, the Director of Materiel Services at UMHHC would like to know how to increase the efficiency of the current process so that cables are properly managed. Changes to the current process will focus mainly on reducing the time spent searching for cables and the money spent to replace cables. To address these problems, the Director of Materiel Services asked our team to conduct a series of studies and analyses to locate the problems and to improve the process. Based on these studies and analyses, the team will recommend a detailed procedure for handling and managing the cables. The purpose of this report is to describe the source of the problem and present a detailed solution. The team has completed these goals by conducting extensive data collection and analysis in order to ultimately propose a new cable management process and further recommendations for improving cable management at UMHHC.

Background
Patients at the University of Michigan Hospitals and Health Centers are regularly transferred from one unit to another. When patients require cardiac monitoring, the patient’s health is monitored via a portable cardiac monitor. A patient’s health is also monitored in their respective unit, via fixed monitors. Cardiac cables connect the patient to the monitors. When a unit needs a cable or any other equipment, it typically orders it from the Materiel Services department, who then charges the unit for the item. Each unit maintains its respective budget.

Definitions
A few important terms must be defined before the current cable management process can be explained.

Brain. The “brain” is a unit that connects directly to the cardiac monitors. Figure 1 below shows the brain.

Figure 1. Brain

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The brain has three specific cables that are attached in all instances of its use. One of these cables is the GE Healthcare 5 Lead ECG cable in question. The bottom of Figure 2 below shows the cable in question. The top part of this picture displays the lead portion of the cable, which is connected to the patient directly.

Figure 2. GE Healthcare 5 Lead ECG Cable and Associated Leads

The other two cables will be left out of the scope of this report. However, the results in this report should easily be extended to include the other two cables which are used in connection with the brain.

Sending and Receiving Units. The sending unit is defined as the unit from which the patient leaves as the patient is transferred to another unit. The receiving unit is defined as the unit to which a patient in transfer is destined.

Cable Management Process. The team defined the “cable management process” to transfer a patient from one unit to another as follows:

1) The brain is removed from the fixed monitor and placed into the portable cardiac monitor, while leaving the cables attached to the patient. (Patient is transferred with brain and cables only if necessary; otherwise, the patient is transferred with only leads attached.)
2) The patient is moved to the next unit accompanied by a nurse from the sending unit and a transporter.
3) The patient is attached to the fixed monitor in the new unit.
4) The nurse from the sending unit obtains a brain with cables from the destination unit and returns it to the previous unit.

This flowchart below describes the current idealized cable management process. That is, the process below is the way that the system should work. However, as the team will address later in this report, this process is not followed correctly.

**Key Issues**
The following key issues were driving the need for this project:

1) Patient safety issues arise from problems with the cable management process.
2) Cardiac monitor cables are often lost and misplaced under the current cable management process.
3) Time is lost searching for cables and replacing lost cables.
4) Nurses complain of frustration due to lost cables

**Project Scope**
This project examined only GE Healthcare 5 Lead ECG cables and hospital units that use these cables. The hospital units included in the project are the Post Anesthesia Care Unit (PACU), Cardiac Procedures Unit (CPU), Medical Procedures Unit (MPU), the Operating Rooms, Emergency Department, and the patient care units of the University Hospital (4-8ABCD) and the Cardiovascular Center (4&5). The project is limited to the University Hospital and Cardiovascular Center, but the team believes the findings from this project will be applicable to other hospitals and clinics in the Health System. The project excluded all other UMHHC sites such as Mott, Kellogg, East Ann Arbor, Livonia, and the East Ann Arbor Surgery Center. The team also excluded all other cables that the hospital uses. However, the team suggests that the implementation of the proposed cable management process be extended to the other two cables that are always used in connection with the brain.

**Project Goals**
There are significant financial costs and nurse inefficiency issues that have arisen as a result of the problems of the cable management process. The primary goal of this project was to recommend a modified current cable management process. The team reached this goal by accomplishing the following tasks:

1) Develop a more efficient cable management process
2) Recommend a process and written policy for the cable management process

We worked to recommend improvements to the current process and accomplished the aforementioned primary goals with these secondary goals in mind:

1) Minimize the time required to search for cables
2) Reduce the number of lost cables
3) Maximize patient safety
4) Minimize implementation costs of the new process
5) Make cables readily available in each unit for exchange with another unit

**Methodology**
Our team has collected and analyzed data to identify the cable management problems at UMHHC.

**Literature Search**
The project began with an extensive literature search to find any previous research done in this area. Our search for similar material consisted of using the University of Michigan website and Google to find previous work on cable management. This is the first IOE 481 student project to address the topic of cable management.

**Interviews**
To gain a deeper understanding of the cable management process and its corresponding issues our team interviewed key hospital personnel in person, over the phone, and via email. The team conducted interviews with the following employees of UMHHC:

1) Clinical Nurse II from the UH 5D department
2) Nursing Manager of the PACU
3) Nursing Supervisor UH Cardiac Intensive Care Unit 7D
4) Representative from the Biomedical Engineering department
5) Supervisor of Patient Transportation
6) Capital Asset Supervisor from Capital Budgets
7) Warehouse Manager of the Materiel Services Department
8) Value Analysis Director

Our questions focused on current processes, apparent problems, possible solutions, and relevant inventory and purchase data.

**Process Observation**
In order to corroborate much of the information that was gathered in the interviews, the team observed the cable management process from its own point of view. The purpose of first-hand observation was to garner a better understanding and feel for the current process.

**University HealthSystem Consortium (UHC) Data**
The next phase of the project assessed the UHC survey data results. The survey was sent out by the Materiel Services department to other consortium health systems. The purpose of the survey was to assess the extent of the cable management issues at other hospitals and also determine differences in the respective cable management processes. The survey posed the following questions:

1) Have you implemented a successful solution for this challenge at your organization?
2) What level of person is responsible for tracking and maintaining cables on each unit?
3) Do you manage the cables centrally?
4) If so, who pays when there are insufficient cables?

The health systems that participated in the survey were: Froedtert Memorial Lutheran Hospital, Albany Medical Center, The Ohio State University Medical Center, Penn State Milton S. Hershey Medical Center, University of Virginia Health System, John’s Hopkins Hospital,
University of New Mexico, University of Alabama-Birmingham University Hospital, and University of Texas Medical Branch.

**Inventory**
An inventory of cardiac monitors throughout the University hospital was critical in finding the portions of the hospital that use the most cables and thus, are affected the most by the cable management problems. Initially, our team believed that a physical inventory count would be necessary to determine the locations of the monitors. However, we determined that this task was unnecessary and thus sought to find the data through the Capital Assets Supervisor of the Facilities Services division of the UMHHC. He provided the inventory data to pinpoint the locations and numbers of cardiac cable monitors throughout the areas of the hospital included in the project’s scope.

**Purchase Report Data**
The purchase report data that our team collected are essential in determining the cost associated with lost cables at UMHHC. The data also allowed the team to determine which departments were affected the most by problems with the cable management process. The purchase report data came from two sources to ensure its accuracy. First the Value Analysis Director provided data that marks the purchasing information by department from November 2006 to October 2007. The other source, Warehouse Manager of the Materiel Services Department, provided purchasing data broken down by month since November 2005. Crosschecking the data from these two sources provided increased accuracy for the project. These data helped to assess the amount of money that is lost per year due to lost cables.

**Flow Chart Analysis**
Throughout the project, our team has maintained and constantly updated the flow chart for the cable management process. Our team developed a detailed flow chart for the current cable management process as it actually works, a flowchart of the current idealized process, and a flowchart of the proposed new process. These charts allowed for better understanding of the main problems with the current process and helped develop solutions for the new process.

**Nurse Survey**
The next phase of our methods consisted of a survey passed out to nurses in the following units: PACU, Emergency Department, and UH units 4D, 5D, 6B, and 7D. The results of the survey are important for the following reasons:

6) Assess the awareness of the current cable management process in place  
7) Determine the frequency of lost cables  
8) Quantify the amount of time spent looking for lost cables  
9) Determine how many nurses follow the current process  
10) Allow for feedback on our team’s potential solution

The nurse survey can be found in Appendix A.

**Findings**
The current cable management process has an array of problems. The team conducted extensive data collection in order to fully understand the current process and situation. This was done through a variety of tasks beginning with the literature search and continuing with hospital employee interviews.

**Current Process**

The team’s initial data collection and analysis phase consisted of determining the condition of the current cable management process at UMHHC and other hospitals throughout the country. The team accomplished this task through a literature search, UHC survey, and employee interviews.

**Literature Search.** The literature search did not yield any previous IOE 481 work on hospital cable management processes. Thus, the team formulated its own approach and ultimate recommendations without any guidance from previous work. The team hopes that this project can be the groundwork for other IOE 481 student teams and help with any other cable management projects that occur in the future.

The team found through our online search an article that relates directly to the problem at hand. In Volume 33, Issue 5 of the *Journal of Emergency Nursing*\(^3\), there is discussion of equipment loss. The journal posed the following question: “What strategies have you implemented to keep track of or to minimize loss of equipment and supplies within your department?” The answers to the question came from nurse managers and directors at the following hospitals: Frankford Hospital in Philadelphia, Sentera Virginia Beach General Hospital, Lake Charles Memorial Center, Holy Cross Hospital, Vanderbilt Emergency Department, and Lehigh Valley Hospital and Health Network.

The nurse manager in the Vanderbilt Emergency Department stated that her department was “losing and replacing about $330,000 a year in cables.” Her department’s resolution to the problem was to purchase “cord caddies” (a place to hang cardiac cables), so that the cables would have a designated hanging place in plain view.

The nurse manager at Frankford Hospital said that “our biggest challenge is keeping a full set of monitor cables in each room.” Nurses would grab cables when needed and, as a result, the hospital would “wind up with extra cables in some rooms and not enough in another.” Also, the nurse manager claimed that the hospital “would lose cables during patient transports.” The solution at Frankford Hospital involved a system to keep the cords tied together. One of the charge nurses came up with a “spiral wrap product” that would secure the sets of cables together. The result of this solution was that “replacement of cables and not being able to find them is almost a nonissue.”

The other responses yielded a couple other potential solutions to minimizing equipment loss. One of the solutions included creating “a locked drawer in the nurses’ station that contains our

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‘high risk’ missing items. The charge nurse has the key to the drawer and is held accountable for returning borrowed device(s).” Another interesting solution was to keep a log for “equipment that goes outside of our department.” This serves as a good way to keep track of borrowed and exchanged equipment.

University HealthSystem Consortium (UHC) Data. The Value Analysis Director provided our team with the UHC survey data which included information regarding cable management processes at other University Health Systems. Almost all of the hospitals in the survey complained of having either the same or a similar problem to the one facing UMHHC.

A number of the hospitals stated that patients are often transferred without the brain. They realized that this was not ideal because much of the patient information was lost in the transfer between units.

The Albany Medical Center explained that they do not have brains to maintain patient information during transfer. Thus, the patient is connected to the sending unit’s transport monitor. If the transport monitor cables can be disconnected, then they will reconnect them to the receiving unit’s monitor and take the receiving unit’s cables for the transport monitor. If the transport monitor cables cannot be disconnected, then the patient will be disconnected from the cables and the transport monitor with cables will return to the sending unit.

The UAB University Hospital said that the monitors in its Emergency Department are different from the monitors in the other units. Thus, the ED has transport monitors to take the patient to the next unit and cables are never exchanged. However, this again leads to the loss of patient information during the transfer.

Clinical Nurse II. The nurse provided an overview of the original design of the process, perspective on the problems with the current process, and potential process adjustments. After the initial implementation of the current process, there was a long time before complaints about the process started. She also stressed that the receiving unit is responsible for having cables ready to exchange. There is a common practice of “swap or no deal,” which means either the sending and receiving units swap cables or the sending unit is supposed to remove the cables from the patient and return to the sending unit with the cables. Disconnecting the cables from the monitor rather than the patient was said to be easier. The clinical nurse said that UMHHC currently has no written procedure detailing the cable transfer process.

Nurse Manager of PACU. The Nurse Manager provided her perspective on the design of the patient transfer process, the problems with the way the process is currently being practiced, and potential ideas for process improvement. She explained the patient transfer process in depth. Nurses move the patients from one unit to the other and they are supposed to receive new cables. When the patients are moved, the brain, with all the cables connected, is taken from the fixed monitor and put into the portable monitor.

Appendix B displays a flow chart of the patient transfer process based on the information received in these two interviews.
Nursing Supervisor UH CICU 7D. The nursing supervisor for the Cardiac Intensive Care Unit provided valuable insight into the cable management process and problems at UMHHC. The interview confirmed our team’s knowledge of the current cable management process. Cables are supposed to be transferred as a set with the brain and upon arrival in the receiving unit, an exchange of cables is supposed to be made. The nursing supervisor pointed out the following problems associated with the current process: no written policy to describe the cables. When a unit is missing a cable, the unit must call other units to see if there are extra cables or else order a new cable from maintenance and get charged for it. The nursing supervisor also suggested a potential solution for improving the current process: cables should be mounted to the monitors and there should be a central hub for cable storage and retrieval.

Supervisor of Patient Transportation. The supervisor explained the patient transport process from the point of view of the transporter. This interview confirmed the team’s initial belief that the patient transporters had nothing to do with the problem.

Inventory and Purchase Data
The next phase of the project required the collection of cardiac monitor inventory data, cardiac cable purchase report data, and UHC survey data. The team received inventory data from the Capital Asset Supervisor of the Capital Budgets division and purchase report data from the Warehouse Manager in the Materiel Services department. The team received the UHC survey data from the Value Analysis Director.

Inventory Data. The inventory count that was provided to our team consisted of the inventory of all cardiac monitors that use the GE Healthcare 5-Lead cables in question. The search for this inventory queried the Maximo Biomedical database and included the following GE monitor models:

1) Solar9500
2) Solar8000M
3) Solar8000i
4) Dash4000
5) Dash3000
6) ProV2

Table 1 below shows the top 10 departments with the most cardiac monitors.

<table>
<thead>
<tr>
<th>Department Description</th>
<th>Net Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing Administration</td>
<td>104</td>
</tr>
<tr>
<td>Emergency Department</td>
<td>66</td>
</tr>
<tr>
<td>Nursery Intensive Care Unit</td>
<td>47</td>
</tr>
<tr>
<td>Post Anesthesia Care Unit – UH</td>
<td>47</td>
</tr>
<tr>
<td>Anesthesia – UH</td>
<td>47</td>
</tr>
<tr>
<td>Nursing Surgery 4C</td>
<td>42</td>
</tr>
<tr>
<td>Bio-med</td>
<td>37</td>
</tr>
<tr>
<td>Renal/General 7B</td>
<td>37</td>
</tr>
<tr>
<td>Cardiology 7C</td>
<td>35</td>
</tr>
<tr>
<td>Medical Procedures Unit</td>
<td>33</td>
</tr>
</tbody>
</table>
The Nursing Administration Department contains the most monitors in the University Health System. They have 104 monitors that use the cables in question. The University Health System has 1,151 relevant cardiac monitors in total.

*Purchase Report Data.* The following table shows the purchase report data from November, 2006 through October 2007. Table 2 presents the data from the entire UMHHC including departments that were not in this project’s scope.

**Table 2. Cardiac Cables Purchase Report Data**

<table>
<thead>
<tr>
<th>Department Description</th>
<th>Net Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materiel Services – Patient Equip Total</td>
<td>38</td>
<td>$3,730.72</td>
</tr>
<tr>
<td>Emergency Department Total</td>
<td>31</td>
<td>$3,019.64</td>
</tr>
<tr>
<td>Anesthesia – UH Total</td>
<td>27</td>
<td>$2,597.13</td>
</tr>
<tr>
<td>Post Anesthesia Care Unit - Mott Total</td>
<td>18</td>
<td>$1,769.17</td>
</tr>
<tr>
<td>Medical Procedures Unit – Tech Total</td>
<td>16</td>
<td>$1,539.04</td>
</tr>
<tr>
<td>East Ann Arbor MPC Total</td>
<td>14</td>
<td>$1,384.41</td>
</tr>
<tr>
<td>Anesthesia – Mott Total</td>
<td>10</td>
<td>$961.90</td>
</tr>
<tr>
<td>Nursing 6D CCMU Total</td>
<td>8</td>
<td>$769.52</td>
</tr>
<tr>
<td>Nursing 7D CCU Total</td>
<td>7</td>
<td>$688.43</td>
</tr>
<tr>
<td>Cardiac Procedures Unit – Central Total</td>
<td>6</td>
<td>$614.89</td>
</tr>
<tr>
<td>Post Anesthesia Care Unit - UH Total</td>
<td>6</td>
<td>$614.89</td>
</tr>
<tr>
<td>Radiology CVC- Angio/IR Total</td>
<td>5</td>
<td>$480.95</td>
</tr>
<tr>
<td>CVC-5 Total</td>
<td>5</td>
<td>$480.95</td>
</tr>
<tr>
<td>Pediatric Cardio/Thor ICU Total</td>
<td>4</td>
<td>$384.76</td>
</tr>
<tr>
<td>Unit Mgmt Mott-5 Total</td>
<td>2</td>
<td>$199.93</td>
</tr>
<tr>
<td>B2 Procedure Room Cancer Center Total</td>
<td>2</td>
<td>$192.38</td>
</tr>
<tr>
<td>Hospital Dentistry Total</td>
<td>2</td>
<td>$192.38</td>
</tr>
<tr>
<td>7 B/C Cardiology Total</td>
<td>1</td>
<td>$111.29</td>
</tr>
<tr>
<td>4B/C Card/Thor/Vas Total</td>
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<td>$96.19</td>
</tr>
<tr>
<td>4A Neuro-Neurosurgery Total</td>
<td>1</td>
<td>$96.19</td>
</tr>
<tr>
<td>Crc-Patient Care/Pediatrics Total</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Nursing 8B Gynecology/Oncology Total</td>
<td>-1</td>
<td>$103.74</td>
</tr>
<tr>
<td>East Ann Arbor Operating Room Total</td>
<td>-2</td>
<td>$192.38</td>
</tr>
<tr>
<td>Holden ICU Nursery Total</td>
<td>-3</td>
<td>$288.57</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>198</strong></td>
<td><strong>$19,340.07</strong></td>
</tr>
</tbody>
</table>

From November 2006 through October 2007, there were 16.5 lost cardiac monitor cables per month, translating to a monetary loss of $1611.67 per month. The most affected departments are clearly the Emergency Department, Anesthesia department, and the Medical Procedures Unit. The above data is based almost totally on lost cables as the team discovered through its interviews that damaged cables are quite rare. If we were to generously estimate that 10% of
these replaced cables were damaged, there would still have been 178 lost cables and over $17,000 of money spent to replace them.

**Nurse Survey.** The team conducted a survey of 32 nurses in the following units: PACU, Emergency Department, and UH units 4D, 5D, 6B, and 7D. There are a number of important findings from the survey. Figure 3 below displays the percentage of nurses that believe that there is a problem with the current cable management process at UMHHC.

**Figure 3. Cable Management Problem Awareness**

There is certainly a perceived problem by most nurses as 42% strongly agree with the statement and only 3% strongly disagree. Another issue that was discovered in the survey is the fact that 28% of the nurses did not know that there is supposed to be a standardized cable management process throughout UMHHC. Figure 4 below shows the frequency that nurses search for missing cables.

**Figure 4. Frequency of Search**
Of the 32 nurses surveyed, 43% claimed that they were searching for missing cables on a daily basis. The following question that the nurses answered gave the team data on the average time spent by a nurse to look for cables. The answers for this question ranged significantly and thus, the team decided to eliminate outliers from the data. With the elimination of this data a nurse will spend, on average, 24 minutes per week looking for lost cables. This is quite a significant amount of time for a nurse to spend accomplishing nothing of value.

**Flow Chart Analysis**

The flow chart for the current observed cable management process can be found in Appendix C. After developing the recommendations for a new process, the team created a flow chart of this new proposed process which can be found in Appendix D. The flow chart of the current process allowed the team to pinpoint specific problems. Examining the current process flow chart, it is clear that one of the obvious problems is the inconsistency with the procedures. Patients are not always transferred with cables. Cables are often not exchanged between the sending and receiving units.

**Conclusions**

The exchange portion of the current process is the most problematic. This and other relevant conclusions set the groundwork for our team to make recommendations for the development of a new cable management process.

**Observed Problems**

Through the investigative process, the team observed various problems with the current cable management process.

**Absence of Standardized Process.** The most obvious problem is the absence of a standardized cable management process. Without a standardized process, each department operates differently from others. One department may be storing cables while another is consistently using their budget to order replacement cables. A standardized process will eliminate confusion with the current process and add consistency to the exchange process.

**Cables not ready for Sending Unit Nurses.** Another problem with the current cable management process is that sending unit nurses arrive at the receiving unit and there are no cables for them to exchange. Often times the sending unit nurse waits while the receiving unit searches for cables. Searching for cables is not an efficient use of a nurse’s time. Furthermore, nurses have expressed frustration that they must spend time searching for missing cables.

**Some Departments Purchase Disproportionate Quantities of Cables.** The purchase report data showed that some units ordered significantly more cables than others. One explanation is that different units have different numbers of cardiac monitors. As discussed above, the Emergency Department has 65 cardiac monitors which explain the quantity of 31 cable purchases from November 2006 to October 2007.

**Possible Resolutions**
There are two main issues that are addressed in the team’s recommendations. These problems are the absence of a standardized cable management process and the loss of cables due to the inability to properly conduct the exchange of brain and cables between the sending and receiving units. The implementation of a standardized, more efficient process should significantly reduce the nurse dissatisfaction, reduce money spent on replacement cables, and improve the efficiency of the process.

*Patients never transferred with cables and brains.* One solution is to unhook the patient from the cables and transfer the patient while cables stay in their respective units. There are numerous drawbacks to this policy. The most obvious drawback is that it will be very time consuming as well as disruptive to the patient to consistently connect and disconnect cables and wires from the patient. Another serious drawback is that patient history stored with the brain will be lost. These two drawbacks make this policy a poor candidate.

*Cables and brains attached and exchanged during the patient transfer process.* This policy is our recommendation and is outlined in detail in the following section.

**Recommendations**

Our team conducted extensive analysis to develop recommendations for the improvement of the current cable management process at UMHHC. The recommendations will address the primary goal of improving the current cable management process at UMHHC. Furthermore, implementation of the following recommendations will provide extensive benefits to UMHHC. The team has assessed the benefits of a new process on different levels: cost savings from the decrease in loss of cables, increased patient safety from the new process, and implementation cost to UMHHC.

**New Process**

The team recommends a new cable management process that consists of the following necessary elements:

3) Cables should be attached to the brain and possibly fastened
4) A patient will always be transferred with the brain and all necessary cables attached, regardless of the unit of origination
5) At least one nurse from the sending unit will accommodate the patient from the sending unit to the receiving unit
6) The sending unit nurse is solely responsible for receiving a replacement brain and cables from the receiving unit
7) The receiving unit must have a replacement brain and cables on hand before the nurse from the sending unit arrives with the patient
8) A log of the transaction between the sending and receiving unit will be kept by each individual unit to document the improper exchange of brain and cables

A flow chart of this new process is included in Appendix C.
Additional Recommendations
A key additional recommendation is that the three main cables associated with the brain must be attached. “Attached” in this instance does not mean that the cables must be fastened to the brain, but it is essential that the cables are treated as such. As mentioned earlier, there are currently no problems with losing the brains in the hospital. The reason for this may be partly in due to their size or cost. Thus, in treating the cables as part of the brain, it is much less likely that cables will in fact be lost.

The team decided upon a few other key recommendations from the UHC survey responses and literature search results. The first of these additional recommendations is the tie the three cords that are always used with the brain together. This will also help to eliminate the loss of the cables because they will be attached in a bundle much larger than each individual cable. Furthermore, the team recommends that the hospital should implement a policy that cables are never to be left in drawers. Cables should always be in plain view on top of counters or potentially hanging from hooks attached to the wall. This is yet another method that will minimize the loss and misplacement of cables.

Finally, the implementation of new cable process must also be accompanied by a written policy. Currently, there is no formal documentation of the cable management process. As the team has noted earlier in the report, the lack of this documentation adds significantly to the current issues. Upon implementation, nurses in all units must be briefed to ensure that all nurses fully understand the new cable management process.

Benefits
The implementation of the new cable management process will positively affect the University Health System in a number of ways including: cost savings, nurse efficiency, and nurse satisfaction.

Cost Savings. The implementation will save the University approximately $17,000 per year in lost cables (including the estimate for damaged cables). Although this figure may seem insignificant, it must be considered in the context of UMHHC’s implementation cost which, as was discussed before, is non-monetary.

Nurse Efficiency. Finally, there will be a decrease in time that nurses spend finding new cables or searching for missing cables. From the nurse survey, the team concluded that nurses spend 24 minutes per week on average looking for cables. With the implementation of the team’s recommendations this time will eliminated altogether. The reduction in this time spent looking for cables will, in turn, increase the efficiency and utilization of the nurses.

Nurse Satisfaction. The frustration that many nurses have complained of will be alleviated with the new cable management process. Through the interviews and survey responses, the team gathered extensive complaints regarding the frustration associated with lost cables. This frustration leads to nurse dissatisfaction, which in turn, can lead to the nurses carrying out their tasks with less care and more haste. Again, the implementation of the team’s recommendation will significantly reduce the number of lost cables and relieve the frustration that nurses deal with in searching for lost cables.
Action Plan

The implementation of this new cable management process is simple and inexpensive. The benefits of the new process are significant from a variety of aspects. The team believes that the time to implement this new process will also be minimal. Taking all of this into account, the team recommends the immediate introduction of this new process to all hospital employees and its subsequent documentation into the hospital’s written policies.
Appendix A. Nurse Survey

Cable Management Process Survey

Survey Background:

This survey is being conducted for an IOE 481 Student Project. The project is a study on the Cardiac Monitor Cable Management Process at the University of Michigan Health System. Currently, Frank Krupansky, Director of Materiel Services, has stated his concern with lost and damaged Cardiac Monitor Cables. Specifically, the cables our team is studying are the GE Healthcare 5 Lead ECG cables. This survey will be helpful in assessing the overall problems/issues based on a large number of different opinions.

1) There is a problem with the current Cable Management Process at the UM Health System

   Strongly Disagree                       Strongly Agree
   1   2   3   4  5

2) How often do you find yourself searching for missing cardiac monitor cables?
   At least:
   Once a Day       Once a Week       Once a Month       Never

3) If applicable, how many minutes, on average, do you search for missing cardiac monitor cables?

4) What do you do when you cannot find a cardiac monitor cable?

5) What do you do with extra cardiac monitor cables?

6) Are you aware that there is supposed to be a standard system for cardiac cable management when transferring patients between units?

   Yes                     No

7) From your understanding, which of the following most closely describes the cardiac cable management process as it is supposed to work under ideal circumstances?

   A: Cardiac cables are transferred with patients when necessary. A nurse from the sending unit accompanies the patient to the receiving unit. When the patient reaches the receiving
Appendix A. (Cont.)

unit, he/she must receive an exchange set of cables from that unit to return to the previous unit.

B: Cardiac cables are transferred with patients when necessary. A nurse from the sending unit accompanies the patient to the receiving unit. When the patient reaches the receiving unit, he/she must disconnect the patient from the cardiac cables and return to the previous unit with the original set of cables. Cables belong to individual units.

C: Cardiac cables are never transferred with the patients and always remain in the unit where they are used.

8) We have come up with a potential solution to the cable management process and would like your feedback regarding our idea. Specifically, can you identify potential problems with this new process?

Solution: Cardiac cables are considered “fixed” to the “brain.” This does not necessarily mean that they must be fastened to the brain, but they should be considered as such, so that they are never disconnected from the brain. Cardiac cables are transferred as a whole with the brain. Receiving units must always have a brain with cables on hand to give the nurse from the sending unit when a patient arrives. The nurse from the sending unit returns to his/her home unit with the exchange brain and cables. Patients are always transferred with a brain and cables regardless of necessity. A transaction log is kept by both the sending unit and the receiving unit to record the exchange of brain and cables.

Potential Issues:
Appendix B. Flow Chart of Current Ideal Patient Transfer Process

1. Patient arrives
2. Receiving Unit gives replacement brain & cables to Sending Unit Nurse, who returns, with equipment, to respective unit
3. Nurse removes idle brain from fixed monitor & locates a cardiac cable (Cardiac cables may be found attached to the brain, stored in a designated area, or collected loosely in the unit)
4. Call other units for extra brain and/or cable, or call maintenance & order new replacements

*Sometimes this occurs in anticipation of patient arrival

- Does receiving unit have brain & cardiac cable to exchange?
  - Yes: Nurse removes idle brain from fixed monitor & locates a cardiac cable. Receiving Unit gives replacement brain & cables to Sending Unit Nurse, who returns, with equipment, to respective unit.
  - No: Patient transferred only with leads attached.

- Patient ready to be transferred
  - Does patient need to be transferred with cardiac cable and brain?
    - Yes: Patient transferred while connected to portable monitor with brain and cardiac cable attached (Accompanied by sending unit nurse).
    - No: Patient transferred only with leads attached.

- Patient arrives
  - Disconnect patient from portable monitor & connect to fixed monitor. Nurse from sending unit waits for replacement brain & cardiac cable.

- No
  - Patient transferred only with leads attached.

- Yes
  - Patient transferred while connected to portable monitor with brain and cardiac cable attached (Accompanied by sending unit nurse).

- Call other units for extra brain and/or cable, or call maintenance & order new replacements.
Appendix C. Flow Chart of Current Observed Patient Transfer Process

Patient ready to be transferred

Does patient need to be transferred with cardiac cable and brain?

No

Patient transferred only with leads attached

Yes

Patient transferred while connected to portable monitor with brain and cardiac cable attached (Accompanied by sending unit nurse)

Patient arrives

Monitor brain is transferred from the portable monitor with its cables to the fixed monitor. Nurse from sending unit waits for replacement brain & cardiac cable

Does receiving unit have brain & cardiac cable to exchange?

No

Call other units for extra cables, or call maintenance & order new replacements

Yes

Receiving Unit gives replacement brain & cables to Sending Unit Nurse, who returns, with equipment, to respective unit

Did the receiving unit nurse find a cardiac cable?

No

Nurse from sending unit goes back to her unit without cables

Yes

*Sometimes this occurs in anticipation of patient arrival
Appendix D. Flow Chart of Proposed Patient Transfer Process

1. **Patient arrives**
2. **Patient transferred while connected to portable monitor with brain and cardiac cable attached (Accompanied by sending unit nurse)**
3. **Patient ready to be transferred**
4. **Disconnect patient from portable monitor & connect to fixed monitor**
   - Nurse from sending unit waits for replacement brain & cardiac cable
5. **Does receiving unit have brain with cardiac cable to exchange?**
   - **Yes**
     - Nurse removes idle brain, with cardiac cable attached, from fixed monitor
     - Receiving Unit gives replacement brain & cables to Sending Unit Nurse, who returns, with equipment, to respective unit
   - **No**
     - Call other units for extra brain/cable, or call maintenance & order new replacements
     - Record “failure to deliver” in history log & receiving unit charged for purchase of replacement brain and cables
6. *Sometimes this occurs in anticipation of patient arrival*