University of Michigan Health System
Program and Operations Analysis

Analysis of Current Medication Reconciliation Processes in Adult Medical and Surgical Services, the Maternal Child Health Center, and Psychiatry

Final Report

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Executive Summary
Analysis of Current Medication Reconciliation Processes in Adult Medical and Surgical Services, the Maternal Child Health Center, and Psychiatry

Study Conducted by UM Industrial and Operations Engineering Students:
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Under the supervision of: Mary Duck
By Request of: Maureen Thompson of the Office of Clinical Affairs, Catherine Christen of the Pharmacy Services department and the Medication Reconciliation Project Team

Background

Medication reconciliation is the process of creating an accurate list of all medications a patient is taking and comparing that list against the physician’s admission, transfer, and discharge orders, with the goal of providing correct medications to the patient at all transition points within the hospital. Medications include all prescribed medications as well as over-the-counter drugs, herbal remedies, vitamins, vaccines, or sample prescription drugs. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has introduced new national patient safety goals that will be integrated into their hospital reviews beginning January 2006. Goal number eight is to have a policy to accurately and completely reconcile patient medications across the continuum of care. This goal needs to be fully implemented by January 2006.

Objective

The student project team was asked by the Medication Reconciliation Team, a team of department heads and administrators assembled by the Office of Clinical Affairs (OCA), to address JCAHO patient safety goal eight in UMHS, to investigate and provide a complete assessment of the current processes used to reconcile medication across the hospitals. From this information we were also asked to identify areas for possible improvement and waste reduction.

Units Affected by this Analysis

To document the current medication reconciliation process in these areas, the project team conducted surveys, interviews, and observations of key personnel who are affected by the process in the following primary UMHS units:

- Administrative and Technical
  - Office of Clinical Affairs (OCA)
  - Program and Operations Analysis (POA)
  - Continuous Quality Improvement (CQI)

- Medical Information System (MIS)
- Medical Center Information Technology (MCIT)
- Orders Management Project (OMP)
• Inpatient Units
  – 4B/C Thoracic Vascular
  – 6D Medical ICU
  – 5D Surgical ICU
  – 6A Adult Physical Rehabilitation
  – Trauma Burn
  – 7A General Clinical Research Center
  – 6B Internal Medicine
  – 7DS Hemodialysis

• Pharmacy Services
  – Inpatient Pharmacy
  – Outpatient Pharmacy
  – OR Pharmacy
  – Cancer Center (CGC) Pharmacy

• Adult Ambulatory Care and Adult Diagnostic Procedures
  – Rheumatology and Allergy Reichert
  – East Ann Arbor Health Center
  – Physical Medicine & Rehabilitation (PM&R)
  – Internal Medicine Outpatient Clinic
  – Medical Procedures Unit
  – Radiology
  – Cardiac Procedures Unit
  – Emergency Department (ED)
  – Discharge Planning
  – Michigan Visiting Nurses (MVN)
  – HomeMed

• Operating Room (OR)

• Maternal Child Health Center
  – General Pediatrics Inpatient Unit
  – Pediatric Otorhinolaryngology Clinic
  – Pediatric Infusion Clinic
  – Pediatric Intensive/Transitional Care Unit
  – Mott Post Anesthesia Care Unit
  – Pediatric Cardiology Catheterization Lab Clinic

• Psychiatry
  – Adult Psychiatry Unit
  – Child Psychiatry Unit

Procedure

The data gathering procedure was as follows:
1. Medication Reconciliation Team identified areas to investigate and provided a contact for each.
2. Each Nurse/PhysicianPharmacist/Care Provider on the list served as a representative of their respective area. Each was contacted and interviewed about the medication reconciliation process in their area.
3. Forms used in the process were gathered and computer systems were observed while documenting current procedures.
4. Follow-up verification of answers and a ten-question Yes or No survey was sent to each participating interviewee.

Findings

From our interviews we were able to document a detailed process of the current patient and medication information flows in each of the above listed areas. To see a detailed breakdown of each department, refer to the complete report.
Survey Data

We developed a list of questions defining ten key points to collect statistical data on the consistency of procedures across departments. Each question is listed below, along with the percentages of “Yes” responses.

<table>
<thead>
<tr>
<th>Collection of Patient Medication Information:</th>
<th>Patients are the main source of medication information and nurses are the primary UMHS personnel to collect patient information.</th>
</tr>
</thead>
</table>
| 1. When a patient enters your unit who do you gather patient medication information from? | 3. Do you routinely ask about non-standard medications, i.e., herbals, vitamins, etc.?  
84% Patient  
75% Family  
3% Insurance  
63% CareWeb  
59% Other  
48% Yes, 52% No |
| 2. When a patient enters your unit who gathers the information? | 4. Do you routinely ask the patient to verify medication information you obtained from various sources?  
74% Nurse  
65% Physician  
29% Other  
42% Yes, 58% No |

<table>
<thead>
<tr>
<th>Use of UMHS Computer Systems:</th>
<th>Most of the respondents use CareWeb to view patient information.</th>
</tr>
</thead>
</table>
| 5. Which UMHS computer system(s) does your department use? | 6. How often do you check your system?  
94% CareWeb  
16% WORx  
16% Centricity  
10% Discharge Navigator  
3% None (printouts only)  
19% Other  
58% Only upon a patient’s admission to the department  
16% Daily  
29% To verify a change |
| 7. Do you update your system or just view it? | 8. Do you have access to update your system?  
39% View & Update, 61% View Only  
43% Yes, 57% No |
Transfer of Patient Medication Information: Non-standardized method of transfer exists.

9. How do you forward medication information when a patient is transferred?

![Bar chart showing the methods of transferring medication information.]

Other responses included transfer sheets, medical records, medication administration record (MAR), physician consultation, and WORx.

Satisfaction with Current System: Systems work well locally but lack clear communication across departments.

10. Please rate your satisfaction with your current system.

![Pie chart showing satisfaction levels.]

Interview Findings

All of the units had a different method of collecting, updating, and transferring patient medication history. Of the areas that we interviewed none reported to have a perfect system, but
many had good internal practices. Three areas in particular stood out for effectiveness in different categories: General Pediatrics Division, East Ann Arbor Health Center, and Adult Psychiatry Department.

**General Pediatrics Division on the Mott General Care Inpatient Units: Information gathering and internal reconciliation**

The General Pediatrics division has a thorough medication information gathering technique.

- First a nurse checks CareWeb for what information other departments have already gathered on the patient.
- Upon admission to the unit (if inpatient) or clinic (if outpatient), the patient or patient’s parent must fill out a Functional Health Pattern Assessment Form. The form is compared with the information available on CareWeb. The patient or patient’s parent is then asked by both the nurse and the physician separately to verify this information, which includes routinely asking about non-standard medications.
- The General Pediatrics staff thoroughly checks and compares all information that is available to them.
- Each day when a physician goes on rounds to the inpatient units, a floor staff nurse accompanies the physician. The nurse makes note of medication changes and the overall condition of the patient. This extra communication directly between the nurse and the physician is a valuable step in medication reconciliation.
- When a medication is prescribed to a patient, the first nurse to give it compares it to the orders the physician gave to the pharmacy and the plans are discussed in rounds.
- Each evening when the pharmacy delivers new MARs, a night nurse reconciles them with the old MARs and the new orders that were discussed in rounds.

**East Ann Arbor Health Center: Verifying, updating, and communicating patient medication information**

East Ann Arbor clinics have an efficient routine for verifying, updating, and communicating patient medication information.

- When the patient is taken into an exam room, his or her information is pulled up on CareWeb by the medical assistant (MA). The information is then reconciled with the patient to validate its accuracy. If there is a discrepancy, the information is updated immediately.
- The physician then rechecks what the medical assistant has changed on CareWeb. After seeing the patient, the physician will either leave the PSL on CareWeb unchanged or will remove or add medications as needed.
- Because of this practice of verifying and updating records, the EAA clinics have accurate lists on their patients. Also because the list is in CareWeb, it is easily accessible by any UMHS department.

**Adult Psychiatry Department: Educating the patient**

The Adult Psychiatry Department has effective practices for patient education, which leads to discharge medication reconciliation.
• Through their entire stay in the unit, any time a patient medication is prescribed or updated, a complete medication list is printed from CareWeb and given to the patient.
• Along with the current medication list, specific drug information including other names for the drug, side effects, and possible drug and dietary interactions is also given. The patient always has a clear picture of what he or she is taking.
• Especially upon discharge, patients are knowledgeable of their prescriptions and their importance. Patient education prevents patients from not taking their medications and from accidentally double dosing with a generic brand. Also it makes the patients knowledgeable so they have an accurate list upon their next visit.

Conclusions

After interviewing over 30 departments, certain trends began to arise. These trends are the key issues that may need to be addressed when working toward a future system.

Lack of a standardized system and method for obtaining and transferring patient medication information is leading to incomplete and inaccurate information.

• No UMHS-wide medication reconciliation system exists, resulting in the integration of different systems in some departments such as the ED.
• CareWeb is widely used, but it is not consistently updated due to physician time constraints and a lack of inpatient nurse access; this results in a time delay in other units receiving complete and accurate vital patient information.
• A lack of standardized procedures to obtain an accurate medication history and to deliver the updated information to the next care provider exists, leading to redundancies, missed information, and inefficiency.
• The patient usually does not have a complete current home medication list; the patient may not even be aware of what he or she is taking.
• A majority of units surveyed are not asking about non-standard medications, such as herbals and vitamins. However, this information is just as important as prescription drugs.
• A patient might have multiple care providers; UMHS does have access to the medications given by another institution.
• The pharmacist does not generally check the patient’s home medication list. In some cases the pharmacist does not have access to the patient’s pre-admission medication information.
• Some units, particularly the Women’s Birth Center and the Operating Room, use many forms with often redundant information, creating waste.

Unfamiliarity with available information systems and a lack of access prevents some staff from updating medication information.

• Some nurses do not utilize or are unaware of the available information systems, particularly the functionality of CareWeb, resulting in repetitive and inefficient work.
- This lack of use may result from nurses being uncomfortable with CareWeb or computer systems in general, possibly as a result of insufficient training.
- The UMHS data systems are often used as “view only” (61% of the time), preventing updates from being made the rest of the time (39%). This could be due to 57% of the staff not having access (or perceiving they do not have access) to update their systems. A lack of updates causes incomplete and sometimes inaccurate medication information in a patient’s profile.
- A lack of nurse access to update systems such as CareWeb places the burden on the physicians, who experience time constraints that lead to delays in updating important medication information.

**Communication barriers between patients, nurses, physicians, and pharmacists result in incomplete or inaccurate information.**

- Verbal communication is the most widely used means of transferring patient medication information. However, this may lead to inaccuracies if the information is not written down.
- Some units are electronically isolated from other units, such as the Pediatric Otorhinolaryngology clinic, which does not have open communication with other units and therefore does not have a mechanism to verify or update the incoming patient’s information.
- If a child is transferred from the Psychiatry unit, the medication list in his or her file cannot be transferred to other units due to privacy issues and a lack of security in available computer systems, resulting in incomplete information.
- Communication between inpatient nurses, physicians, and the pharmacists is incomplete and inefficient. For example, sometimes the pharmacist is not informed that a medication has been discontinued, resulting in discontinued medications being sent to the unit.
- The current system in the Pediatrics Infusion area within the Taubman Center does not have an information flow from the physician to the pharmacist in the event of prescription change. If the physician changes a prescription for the patient, the pharmacy may not be updated with that information.
- Sometimes orders are illegible for both the pharmacy and inpatient nurses reconciling the MAR. Faxes to the pharmacy can sometimes be hard to read.
- Patients may know their current medications, but still may not know what they need to share with the care provider recording the medication history.

**Information on the Medication Administration Record (MAR) and physician orders may be inconsistent, resulting in the administration of improper drugs or doses.**

- The MAR sent from the Pharmacy to an inpatient unit may be incomplete. For example, it might not include new medications or recent changes in administration times.
- When the physician writes a new order, there is a lead time before the changes take effect and the nurse sees it. This lead time may delay the administration of new medications, and possibly result in the administration of discontinued medications.
- The MAR reconciliation procedure is not fully understood by all nurses, for example those from Central Staffing.
Recommendations

Based on the conclusions above, various strategies are recommended to reduce inconsistencies in the medication reconciliation processes at UMHS. Suggested improvements are grouped by relative expected costs.

Implement a standardized process for obtaining and transferring patient medication information.

Low Cost Improvements:

- Create and implement a standardized procedure for gathering medication information. Include the questions caregivers will ask, which sources they will gather information from, and how they will record this information. Also include which specific care giver will be doing each step of the process. Gathered information should be stored in a place where it can be easily accessed and updated by multiple departments.

- Create a standard method and timeline for updating such a system. In Ambulatory Care units such as the East Ann Arbor Health Center and the PM&R clinics, for instance, the CareWeb PSL is updated each time a patient visits the clinic. This results in instant updates viewable by most of UMHS.

- Educate everyone (nurses, physicians, and any care giver that works with the patient) on the new method. To get their support, stress the importance of medication reconciliation on patient safety, and how a standard process will make their jobs easier.

High Cost Improvement:

- Select a UMHS-wide electronic database for entering patient medication information that can be accessed by all UMHS personnel. Consider using a system that already exists, such as CareWeb, which right now 94% of the units are using. To increase utilization, integrate a more user-friendly and standardized interface for recording patient medication histories, such as a pull-down list instead of the free-text Problem Summary List (PSL). The CareWeb PSL is being consistently updated at the satellite locations, and this system is reported to work effectively. For those units not using CareWeb, an information technology initiative could be started to enable a two-way upload of medication information between CareWeb and any other database, thus making CareWeb a complete source of medication information.

Educate nurses and other staff on how and when to use CareWeb and any other relevant systems.

Low Cost Improvements:

- Hold timely training sessions for new and current personnel who work with the systems. These sessions would include information on the efficient use of relevant databases, as well as their association with other databases in UMHS. Attending the sessions would improve the technology knowledge of staff and increase the efficiency of the medication reconciliation process in the long run.

- Distribute handouts or user manuals to supplement the training.
• Once staff is thoroughly trained, the burden of system updates can be shared among physicians, nurses, and other knowledgeable staff. Sharing responsibility makes staff accountable and should ultimately make them more consistent in their use of these systems, leading to more accurate information in a timely matter.
• Grant access to properly trained staff members to update the system.

Eliminate communication barriers between patients, physicians, nurses, and pharmacists.

Low Cost Improvements:
• Supplement verbal communication with written communication.
• Educate patients on the importance of understanding the medications they are taking and communicating that information to care providers. An effective measure might be the use of awareness slogans on UMHS websites, as well as the addition of statements concerning potential consequences of inaccurate patient medication information on appointment slips. Physicians should also work to educate patients about their medications, including specific drug information, other names for the drug, side effects, and possible drug and dietary interactions. UMHS could also provide a standardized “UM Patient Card” to patients, which would contain a current medication list that would be updated by a UMHS physician. These suggestions aim to improve the medication reconciliation process from the source.

High Cost Improvements:
• Implement the Orders Management Project (OMP) to reduce (1) communication barriers between inpatient units and the pharmacy, (2) steps and waste in the ordering process, and (3) room for human error.
• Ensure no unit is electronically isolated from other units in the new system. To do this, consult information technology specialists to give isolated units integration to the common system.

Ensure nurses are properly trained on the process of reconciling the MAR with physicians’ orders.

Low Cost Improvements:
• Educate nurses on how to properly reconcile the MAR with orders. Hold training sessions where a demonstration is done. Create a standard document outlining the process to follow and distribute it to inpatient nurses. Ensure nurses understand the process to follow when a discrepancy exists between the MAR and orders.
• Recommend that MARs be reconciled at the end of each shift, in addition to nightly.
• Stress the importance on patient care of reconciling the MAR.
• Create a standard method for each unit to follow to check for new orders and get them to the pharmacy in a timely fashion so no delay will exist in administering the proper medications.
• Create a special place on the MAR for medications that are administered weekly and an indication that the medication is not to be given everyday.
• Determine the frequency and the root cause of the discrepancies between the MAR and physician orders.
1 Introduction

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) emphasizes the importance of medication reconciliation, a process used to obtain a patient’s most accurate medication information, in all hospitals in the United States of America. JCAHO has issued a patient safety goal to “. . . accurately and completely reconcile medications across the continuum of care”\(^1\) to be implemented by January 2006.

Currently, the University of Michigan Health System (UMHS) does not have a uniform hospital-wide system to store and update a patient’s medication list. Each department within the UMHS develops its own procedure for obtaining patients’ medication lists. The lack of a standardized process can result in incomplete patient medication records that may lead to “. . . errors of transcription, omission, duplication of therapy, drug-drug and drug-disease interactions, etc.”\(^2\)

The Office of Clinical Affairs (OCA) and the department of Pharmacy Services have formed a Health System team to reduce these medication errors and to satisfy the JCAHO requirement. The Health System team’s goal is to create a UMHS-wide system that will enable each medical unit to receive a patient’s most up-to-date and accurate medication list. (Their work plan and documents are in Appendix A.)

To design an effective future medication reconciliation system, the Health System team needs to understand the current state of the medication reconciliation process as it exists in each unit of UMHS. Therefore, our project team was responsible for documenting the reconciliation processes in each unit of Adult Medical and Surgical Services, Pediatrics, the Women’s Hospital, and Psychiatry. How each unit or service provider obtains an accurate list of a patient’s medications and communicates that list to the next care provider are areas captured in this report.

The current state analysis was carried out by two student teams – one responsible for documenting procedures in Adult Medical and Surgical Services, and one responsible for documenting procedures in Pediatrics, Women’s, and Psychiatry. Together, the student teams’ analyses will provide a better understanding of the existing procedures, which will help UMHS improve the quality of their medication reconciliation processes to meet JCAHO standards. The purpose of this report is to present the findings, documentation, conclusions, and recommendations regarding the current medication reconciliation procedures in UMHS.

1.1 Goals and Objectives

To help the Health System team understand the existing medication reconciliation processes of these departments, this project achieved the following goals:

- Determined the information exchange processes between each service, clinic, diagnostic and treatment service (D&T), and inpatient unit, and analyze their effectiveness.
• Compared the procedures used to obtain the list of a patient’s medications within each service, clinic, D&T, and inpatient unit.
• Compared automated and manual medication information obtained within each service, clinic, D&T, and inpatient unit.
• Determined why different practices are used in each service, clinic, D&T, and inpatient unit; which are most effective; and which are the target areas for improvement and waste reduction.

1.2 Background

To reduce medication errors and ensure integrity of the drug ordering and dispensing processes, UMHS has been developing the Orders Management Project (OMP), a “...comprehensive computer system for managing the clinical orders and medication administration process”\(^3\). This system will automate the medication administration process from the time a physician places a prescription order until the nurse administers that medication to the patient. The OMP is predicted to reduce medication errors between ordering and administration. However, it will not be able to prevent errors due to incomplete medication lists. To ensure that the medications prescribed are the correct ones, an effective medication reconciliation process must be implemented.

Medication reconciliation – a process used to identify the most accurate list of all medications a patient is taking, including dosage, frequency, and route – is essential to prevent medication errors and adverse drug events. Reconciliation helps ensure that patients receive the correct medication and accurate dosage anywhere within the health care system. Therefore, it is very important to obtain and document a complete list of the patient’s medications from the appropriate source at each transition point, while ensuring that the list can be communicated accurately within the health care system.

However, each unit in UMHS uses a different procedure to obtain the medication list because of its particular requirements. These discrepancies and lack of a standard method between different units may lead to poor or incomplete transfer of medication information. Consequently, the OCA and the Department of Pharmacy Services have formed a Health System team to develop a process to ensure complete and accurate medication reconciliation across the UMHS system.

Technical analysis was conducted under the Program and Operations Analysis (POA) Department. Two student subgroups within POA worked on parts of the project. One student team was primarily responsible for studying Adult Medical and Surgical Services, while another student team studied the Pediatric, Women’s, and Psychiatry units. The purpose of the student projects was to understand and analyze the current medication reconciliation process (how previous medication orders are compared with new orders and how any differences are reconciled) from admission into UMHS, within all transition units, and until discharge from the system, as well as how that medication information is communicated to caregivers outside UMHS. This current-state analysis will help the Health System team design an effective future-state reconciliation process. The two student teams also conducted joint analyses of units or

\(^3\) Orders Management Project, http://www.med.umich.edu/i/omp/mission.htm
departments that had overlapping components applicable to both teams. Finally, the two teams combined their results, conclusions, and recommendations to create one final report and presentation. Hereafter, the phrase “the project team” will refer to both the Adult group and the Pediatric, Women’s, and Psychiatry group.

1.3 Key Issues

The following key issues drove the need for this project:

- UMHS desires to meet the Joint Commission on Accreditation of Healthcare Organizations’ (JCAHO) goal of completely reconciling medications across the continuum of care.
- For some medical services, the list of medications taken by a patient upon his or her discharge is processed via the Discharge Navigator system; however, the list may not be complete and accurate or may not include other forms of medications such as herbal medicines and non-prescription medications taken from home.
- Insufficient information exists on current medication reconciliation procedures performed in the various key UMHS units.
- Inconsistent reconciliation methods are causing complications in obtaining vital patient medication information when the patient enters a new clinical or hospital setting or transfers from one hospital unit to the next; lack of complete medication information can cause inefficiency and inaccuracy in dispensing medication.
- Inaccurate medication information due to variation in reconciliation methods can result in unforeseen allergic or adverse drug reactions, incorrect doses, drug interactions, medication omissions and duplications, and deaths.

1.4 Scope

As proposed, this project examined the medication reconciliation processes in the Adult Medical and Adult Surgical Service departments, Pediatric units, the Women’s Hospital, and Psychiatry units. The project team documented the current methods used in key entities of these departments, which include clinic, diagnostic, treatment or procedures, and inpatient units. It also examined the flow of medication information across these entities.

This project did not involve documenting the medication reconciliation processes for other primary departments of the hospital that were not listed above. Subsequent steps such as designing the future medication reconciliation system and its implementation strategy were also excluded from the project.

2 Approach and Methodology

The project team examined and documented the current medication reconciliation process from the point at which a patient enters the system to the point at which that patient exits the system. For each UMHS unit studied, the project team mapped and analyzed the current flow of medication information within and across the following entities: clinic, diagnostic and treatment or procedures, and inpatient units.
2.1 Units Affected by this Analysis

To document the current medication reconciliation process in these areas, the project team conducted surveys, interviews, and observations of key personnel who are affected by the process in the following primary UMHS units. A list of all individuals who were interviewed can be found in Appendix Q.

- Administrative and Technical
  - Office of Clinical Affairs (OCA)
  - Program and Operations Analysis (POA)
  - Continuous Quality Improvement (CQI)
  - Medical Information System (MIS)
  - Medical Center Information Technology (MCIT)
  - Orders Management Project (OMP)

- Inpatient Units
  - 4B/C Thoracic Vascular
  - 6D Medical ICU
  - 5D Surgical ICU
  - 6A Adult Physical Rehabilitation
  - Trauma Burn
  - 7A General Clinical Research Center
  - 6B Internal Medicine
  - 7DS Hemodialysis

- Pharmacy Services
  - Inpatient Pharmacy
  - Outpatient Pharmacy
  - OR Pharmacy
  - Cancer Center (CGC) Pharmacy

- Psychiatry
  - Adult Psychiatry Unit
  - Child Psychiatry Unit

- Adult Amulatory Care and Adult Diagnostic Procedures
  - Rheumatology and Allergy
  - East Ann Arbor Health Center
  - Physical Medicine & Rehabilitation (PM&R)
  - Internal Medicine Outpatient Clinic
  - Medical Procedures Unit
  - Radiology
  - Cardiac Procedures Unit
  - Emergency Department (ED)
  - Discharge Planning
  - Michigan Visiting Nurses (MVN)
  - HomeMed

- Operating Room (OR)

- Maternal Child Health Center
  - General Pediatrics Inpatient Unit
  - Pediatric Otorhinolaryngology Clinic
  - Pediatric Infusion Clinic
  - Pediatric Intensive/Transitional Care Unit
  - Mott Post Anesthesia Care Unit
  - Pediatric Cardiology Catheterization Lab Clinic

2.2 Project Methodology

This project team documented the medication information flow across various UMHS entities in two phases: data collection and data analysis. Data collection tasks included: team meetings;
surveys, interviews, and observations of key personnel; a literature search; and collection of baseline data (or design of a method to collect such data). Data analysis involved documenting the current system through flowcharts based on interview and survey responses, and subsequently developing conclusions and recommendations from such documentation.

2.2.1 Data Collection

- **Health System Team Meetings.** To better understand the challenges and difficulties that UMHS might face during implementation of a new process, the project team attended monthly Health System team meetings at which representatives from each affected area were present. At the March 21 meeting, we presented an interim report of our findings to our clients (Patient Safety Coordinator, Office of Clinical Affairs and Clinical Pharmacist, Pharmacy Lead) and the Heath System team. Additionally, by attending a JCAHO live-broadcast, we obtained updated information on JCAHO’s 2005 Patient Safety Goals, which includes complete medication reconciliation across the continuum of care.

- **Surveys.** The project team designed and distributed custom electronic surveys to department contacts to better understand the medication information flows within and across various units. The survey results indicated general trends and consistency across units. A copy of the survey can be found in Appendix B.

- **Interviews.** The project team conducted over 30 interviews with personnel from the units listed above. Interviews were the primary source of data in this project. The project team interviewed physicians, nurses, pharmacists, and administrators who are involved in or familiar with the medication reconciliation procedure in their department. The information gathered during interviews was based on questions from the data collection survey. Information gathered from the interviews enabled the project team to obtain more detailed information than the surveys alone.

- **Observations and Samples.** In certain areas such as the Emergency Department (ED) and the Operating Room (OR), the project team directly observed personnel carrying out the current procedure for reconciling medication information. Key routes by which medication information is transferred across departments were recorded and analyzed with data from the surveys and interviews. Additionally, sample forms used to record medication information such as the Health Pattern Assessment Form were collected. Such sample documents provide detailed information on how medication information is obtained from the patient. These documents are contained in Appendix P and will be referenced below in a discussion of our findings.

- **Literature Search.** To further understand the goals of the medication reconciliation procedure, the project team consulted literature on basic concepts and other organizations’ strategies in implementing a successful medication reconciliation system. Such external literature included previous team projects related to hospital administration efficiency, medical journals, and JCAHO resources on the internet.
• **Coordinator and Client Meetings.** After the submission of the project proposal, we met with our clients and coordinator weekly to discuss and edit the list of personnel to be interviewed, as well as to receive feedback on our progress.

### 2.2.2 Data Analysis

• **Documentation.** During each interview, the project team took detailed notes to understand the flow of medication information in a particular unit. After the interview, one interviewer compiled all notes and forwarded them to the project team. After all interviews from a particular unit were completed, the project team combined the information from multiple interviews to document the current medication reconciliation system in that unit. For each unit, we tried to capture ideal and actual information flows and any suggestions the interviewee gave for improving the system. Finally, we created a flowchart of medication information into, throughout, and out of that particular area. Please see the Findings and Conclusions section below for information from each area.

• **Conclusions and Recommendations.** By analyzing the data and documentation, we were able to identify the various processes carried out in each area as well as any inadequacies that exist, and develop recommendations for improvement and waste reduction.

### 2.3 Collaboration between Student Teams

The two student teams coordinated their data collection and analysis efforts. Some of the personnel interviewed (or surveyed), such as those in Pharmacy Services, provided information relevant to both teams. In these cases, a member from each student team interviewed the staff member together. If a survey was distributed, the results were shared between the two teams. Relevant information either team received from any other source was also shared with the other team.

Each student team was responsible for mapping and analyzing the medication reconciliation procedures in the areas the team studied. The student teams worked together to map and analyze any “overlapping” units (e.g. Pharmacy Services) which were of interest to both teams. The findings and recommendations from both teams were combined and the teams’ individual and joint analyses appear in this report.

Based on the student teams’ documentation of the current system, the Health System team will design and implement a future UMHS-wide standardized medication reconciliation system.

### 2.4 Expected Impact

The results of the project team’s interviews, surveys, and observations will enable the Health System team to see how the processes used in each department fit together and to understand the “big picture” of current medication information flow. We expect our findings to enable UMHS to:

• Understand successful and unsuccessful medication reconciliation processes
• Create a standardized UMHS-wide medication reconciliation process
• Reduce medication errors and near-misses and increase patient satisfaction

3 Support Received from Operating Entities

Our clients acted as the intermediaries between our project team and the larger Health System team working on the medication reconciliation project. They provided us with frequent feedback on how the project was progressing.

The clients also provided the following:

• Approval of survey and interview questions
• Contact information for all staff to be interviewed and surveyed, as well as help contacting the individuals when necessary
• A preferred method and timeline for conducting the interviews
• Clarification of problems or tasks when needed
• Demonstration of CareWeb and other relevant software used in the hospital
• Time to attend weekly meetings and to respond to e-mail communications
• A time, place, and audience for the final presentation

Our project coordinator acted as our professional mentor, as well as a mediator between the client and student team. She served as our resource for questions involving hospital protocol, terminology, and client relations. She also reviewed our work at different stages (proposal, interim report, final report), commenting on content, format, wording, and overall professional appearance. Additionally, our coordinator advised us on technical aspects of our client work, including data collection and analysis. She also showed us the location of any needed resources in the POA department, such as computers and copy machines. We met weekly and exchanged e-mail communications with our coordinator to update her on our progress and request her help and opinions as needed.

4 Computer Systems Overview

UMHS uses several different computer systems. While some communicate with one another, others do not. The computer systems serve as a method of medication communication between departments. The assessed UMHS computer systems are described in detail below. Please see Appendix C for a diagram of the information flows between systems.

4.1 CareWeb

CareWeb is the main computer system that all departments and areas of UMHS can access. The patient’s medication history is stored in the Problem Summary List (PSL) portion of CareWeb. The PSL is in a free text format. Pharmacists and physicians can update PSL information in CareWeb, however only some nurses have authority to do so. Most departments use CareWeb as their main source of medication information before speaking directly with the patient. All patients should have a CareWeb profile. CareWeb downloads current medication list and allergies from WORx into the PSL. A separate and active inpatient medication profile is
downloaded hourly from WORx into CareWeb, which cannot be transferred into the PSL medication list at discharge.

4.2 Centricity

Centricity is used by the Emergency Department, by the anesthesias in the UH Surgical Services, and by the Trauma Burn unit. It has the patient’s health and physical information as well as the medication information. Centricity is linked to CareWeb, so it can be viewed on CareWeb.

4.3 WORx

WORx is the Pharmacy’s computer system. WORx stores any patient’s medication orders and allergy information that are sent to the Pharmacy. WORx regularly uploads its information into CareWeb and it does this regularly. However, WORx cannot retrieve allergy information or the outpatient medication profile that is entered into CareWeb.

4.4 Discharge Navigator (DN)

DN generates the Discharge Summary Report, the Nursing Patient education report and updates the PSL Diagnosis. DN also manages the medication by reconciling the outpatient PSL and inpatient pharmacy medications, and reviewing and correcting the patient’s PSL medication summary and prescription writing. Currently DN is used by some inpatient units.

4.5 WatchChild

WatchChild is currently being used by OB/GYN and the Women’s Birth Center. It stores patient’s prenatal information similarly to CareWeb. Watch Child is not currently compatible with CareWeb. Watch Child is going to be replaced with TraceVU in the future. TraceVU should be more compatible with outside systems. TraceVU is not expected to integrate with CareWeb initially, but it may be possible eventually. WatchChild stores pre-natal visit information including home medications.

4.6 Radiology Information System (RIS)

The Radiology department has a system (RIS) that a patient is logged into when he or she is scheduled for any service performed by the department. A questionnaire is filled out by the patient, which is entered into the system in code numbers that will cause alerts later in the system. However, the computer file does not keep track of when that information was entered. Additionally, no patient medication information is directly shared between RIS and other UMHS computer systems.

4.7 McKesson Pathways

McKesson Pathways is a system used by the Michigan Visiting Nurses (MVN) to store a patient’s medication list. McKesson can do some checks for adverse drug reactions and dosages, but it is not directly linked to other UMHS computer systems.
5 Findings and Conclusions

A survey (Appendix B) with standardized questions about obtaining and transferring patient medication information was distributed to an individual from each UMHS unit of interest. An individual was asked ten questions, some with a simple “Yes” or “No” response, and others with several options from which to choose. In most of the questions with more than one option, respondents were asked to simply state “Yes” or “No” for each option. Therefore, they could select more option for some questions (e.g. for “Which UMHS data system(s) does your department use?”) The results from the survey helped us understand at a macro level the various systems used and determine consistency across units.

The individual responses from each unit can be found in Appendix D. The data was compiled and the findings are reported below.

5.1 Macro Level Understanding of Medication Information Flows between UMHS Units

Based on the survey and interview results, we were able to document and map the medication reconciliation process at the macro level, as well as the information flows and mediums between the UMHS units.

5.1.1 Survey Findings

Based on the data from the surveys distributed to 32 UMHS personnel, the various sources, systems, and individuals associated with handling patient medication information were summarized. Actual survey responses can be found in a table in Appendix D. A summary of the findings appears below. Please note that when a bar graph is presented, the bars may not add up to 100% because respondents were allowed to choose more than one response. The bar graphs thus present the fraction of “Yes” responses to each item.

The survey questions clustered around four main areas: collection of patient medication information; use of UMHS computer systems; transfer of patient medication information; and satisfaction with the current system.

5.1.1.1 Collection of Patient Medication Information: Patients are the main source of medication information and nurses are the primary UMHS personnel to collect information.

The questions in this category dealt with how each unit obtains a patient’s most up-to-date list of medications.

When asked where medication information usually comes from, 84% of the respondents said patients were a source of information (Figure 1a). When the patient is unable to speak, the family is consulted. Over half of the respondents use CareWeb as a source of medication information. Other sources mentioned included documents from a patient’s chart or personnel from a previous unit (if the patient was transferred), the WORx system, nursing homes, and Survival Flight crew (Emergency Department).
Based on the survey data, 74% of the respondents said nurses collected patient medication information (Figure 1b). Other individuals who were listed as collecting information include the physician, physician’s assistant (PA), medical assistant (MA), and pharmacist.

![Graph showing sources of patient medication information](a)

![Graph showing collectors of patient medication information](b)

Figure 1. Patient medication information (a) sources and (b) collectors

Of 29 respondents, 48% said “yes,” and 52% said “no” when asked whether they routinely ask patients about any non-standard medications they are taking (e.g. herbals, supplements, etc.). Finally, only 42% (of 26 responding) said they regularly verify with the patient the list of medications they have obtained from the various sources mentioned above.

5.1.1.2 Use of UMHS Computer Systems: Most respondents use CareWeb.

Ninety-four percent of units surveyed use CareWeb. Other systems, such as WORx, Centricity, and Discharge Navigator are also used, but not nearly as frequently (Figure 2a). In addition to what computer systems they use, units were also asked when they check their system for updates (Figure 2b). Most (58%) said they do check it when a patient is admitted.

Respondents were also asked whether they update their system or just view it. Only 39% (of 31 responding) both view and update their system. The other 61% simply view the system. Only 43% (of 30 responding) perceive they have access to update their system, while 57% reported they do not have that ability. Thus the data suggests that a possible cause for staff inability to update their system is due to (perceived) inaccessibility to so. For example, during interviews, inpatient nurses expressed that they are able to view CareWeb but perceive that they do not have access to update it.
5.1.1.3 Transfer of Patient Medication Information: No standard method exists.

Respondents were asked how they forward medication information when a patient is transferred (Figure 3). Again, they were allowed to select all choices that applied. Verbal responses were the most common (61% responded they use this), but overall the responses varied widely, indicating that no standard method exists for communicating vital patient information to the next provider of care. In the “other” category, WORx, the medical records department, transfer sheets, medication administration record (MAR), and consulting physicians were mentioned.
5.1.4 Satisfaction with Current System: Systems work well locally but lack clear communication across units.

Respondents were asked to rate their current medication reconciliation system on a scale of 1-5, with 1 being the worst, and 5 being the best. The average response was 3.4. A summary of the responses appears in Figure 4.

![Pie chart showing respondents' satisfaction with current system]

1 - Doesn't work 0%
2 - Works somewhat 27%
3 - Works for our needs 17%
4 - Works for our needs and provides some communication to other departments 43%
5 - Works well for our needs and provides clear communication to other departments 13%

Sample period: March – April 2005
Sample size: 30

Figure 4. Respondents’ satisfaction with current system

5.1.2 Macro Level Flowchart

In addition to understanding general trends in obtaining and transferring patient medication information, we documented the actual information flows between departments (Figure 5).

This flow chart shows the ways that medication information is shared between different areas of UMHS. The symbols along the lines connecting departments show the mediums those departments generally use to communicate with each other. Please note that pediatric departments are not individually included in this chart, but are part of the corresponding adult department. For example, Child and Adult Psychology are both represented by the Psychology square on the chart. Additionally, Family Medicine and Ambulatory Care Clinics both have an arrow pointing to them that states “Update CareWeb”. This means that they are connected to every other department through CareWeb as well as within their respective units.

The macro flowchart is a general picture of information flow; the types of flows noted on the chart are not necessarily the only ways of communication, but they are the most utilized and encompass the majority of information flow. As can be seen, the information flows are quite complex and non-standardized. Within each department shown above are multiple units, each of which contains its own information flows. These units are discussed in detail in the next section.
Figure 5. Medication information flows between UMHS units
5.2 Literature Findings

We consulted five articles from refereed medical journals to understand other organizations’ approaches to medication reconciliation. Key findings included ways to obtain baseline data regarding medication errors, specific processes used to reconcile medications, and an emphasis on pharmacy’s importance in the process.

5.2.1 Collection of Error and Adverse Drug Event (ADE) Data for Benchmarking

For organizations to measure the improvements in their systems as a result of a medication reconciliation initiative, they need to collect baseline data on medication errors or adverse drug events (ADEs) for benchmarking. That is, they can compare the number or rate of errors or ADEs prior to implementing the initiative with those occurring after the initiative is in place. Organizations have handled data collection in a number of ways. In some cases the data collection tool itself has become a means for reconciling medication information.

Two organizations mentioned the use of the Institute for Healthcare Improvement’s (IHI) Idealized Design of the Medication System “trigger tool.” The tool is essentially a checklist of 25 items that may be associated with or may cause ADEs. A study was conducted by IHI using the trigger tool to determine the number of ADEs occurring at OSF Healthcare hospitals. The study involved the review of 20 charts per month selected at random from patients staying at least two days in the hospital. If a trigger was found, a clinician was asked to review the chart to see if an ADE had in fact occurred, and whether the patient was harmed. This gave IHI statistics on baseline ADEs prior to implementing a medication reconciliation program. A similar effort was carried out at Luther Midelfort Hospital to measure ADEs.

A different data collection effort was undertaken at The Johns Hopkins University Hospital adult surgical intensive care unit (ICU). In this case, the data collection tool evolved into the medication reconciliation process. The tool was a discharge survey that would be started by the admitting nurse and completed by the discharge nurse. The tool was designed to detect medication errors in patients’ discharge orders. To complete the discharge survey, the nurse had to answer three questions:

1. Are the medications listed in the discharge orders the same as the patient is currently receiving?
2. Are the allergies listed correctly in the discharge orders?
3. Are the patient’s home antihypertensive medicines prescribed?

If the nurse found a discrepancy (answered “No” to any of the above questions), he or she would consult the patient’s physician, as well as the patient regarding allergies and home medications. An error was said to occur if a change had to be made in the discharge orders.

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4 Rozich and Resar, 2001; Whittington and Cohen, 2004
5 Whittington and Cohen, 2004
6 Rozich and Resar, 2001
7 Pronovost et al., 2003
8 Pronovost et al., 2003
After two weeks of baseline data collection, the survey became a regular part of the discharge process. Nineteen weeks of data collection involving 10% of patient discharges each week revealed a decline in medication errors (as defined above) compared with the baseline data. Additional measures including number of medication errors prevented and staff compliance were also obtained from July 2001 through May 2002. Compliance approached 100%.

5.2.2 Other Organizations’ Approaches to Medication Reconciliation

The method used at The Johns Hopkins University Hospital is one way that medication reconciliation can take place. Other methods were reported at OSF Healthcare hospitals and the Luther Midelfort Hospital.

OSF Healthcare, consisting of six hospitals, designed a method in which the same form was used by the nurse, physician and pharmacist.9 The nurse collected a patient’s medication history and then handed that form to the physician, who used it as an order form to state whether each medication should be continued or discontinued. Finally, the pharmacist received the form and was able to reconcile the orders with the home medications listed.

Luther Midelfort Hospital created a system in which a medication history is taken at admission, and, “As the patient moves through the health care system, providers must account for any changes in medications.”10 The authors stressed the importance of a simplified dosing schedule to reduce the likelihood of medication errors. According to the authors, “Published reports have shown that errors occur because patients do not understand dosing schedules and dosing quantities . . . there is often a striking disparity between what is entered in the medical record and what is in the patient’s actual pharmaceutical regimen.”11 That being said, nurses try to obtain not only medication information at admission but also the patient’s dosing schedule. At discharge, both the medications and schedule are again reviewed with the patient to minimize confusion.

5.2.3 The Role of Pharmacists in Medication Reconciliation

All of the organizations studied included pharmacy as a key entity in the medication reconciliation process, but in different capacities. Two articles in particular stressed the important role pharmacists can play.

One article emphasized the importance in general of pharmacists in reconciling medication orders.12 Jacobson stressed that, if a pharmacist feels an order is inappropriate, he or she should look into it more closely by consulting physicians, charts, computer systems, and even the outside pharmacy the patient visits. Consulting the patient’s local pharmacy is an interesting idea that was suggested in several of the articles.

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9 Whittington and Cohen, 2004
10 Rozich and Resar, 2001 (p. 29)
11 Rozich and Resar, 2001 (p. 29)
12 Jacobson, 2002
More specifically, a study at Northwestern Memorial Hospital had pharmacists entirely responsible for the reconciliation process. Pharmacists interviewed patients to obtain their medication histories and compared this information with information from the admission orders, a physician history, and an admission profile completed by the nurse and patient. In this way, information from three sources was reconciled with the admission orders. In the case of a discrepancy, the pharmacist would seek various sources for clarification. In some cases, the physician was consulted. An order that had to be changed was considered an error. Errors were evaluated based on whether they could cause patient harm. In this study, a savings of $39,000 was estimated for the potential harmful errors averted, with only $5,000 spent on pharmacists for their work in the reconciliation process. Therefore, if staffing allows, it may be reasonable for other health systems such as UMHS to look into providing more responsibility to pharmacists in the medication reconciliation process.

5.2.4 Recommendations based on Literature Findings

A number of diverse methods for collecting medication error information and reconciling medications were suggested above. It would be appropriate for the medication reconciliation team at UMHS to study these organizations’ approaches and see if any are compatible with UMHS’s goals and resources.

5.2 Micro Level Understanding of Medication Information Flows within UMHS Units

Based on the interviews conducted with personnel in UMHS units of interest, we created a micro level flowchart of the medication reconciliation process within each unit, and identified inconsistencies, as well as areas for improvement and waste reduction. Following the interview findings is a discussion of our conclusions based on these findings.

5.2.1 Maternal Child Health Center

5.2.1.1 General Pediatrics

The project team interviewed the Manager of Clinical Nursing in 5 Mott West and an attending physician. Findings are reported below.

**Current Process.** The current patient and medication information flows in the inpatient unit of General Pediatrics are as follows. (Please refer to the flowchart in Appendix E-1 for an illustration of the following description.)

1. 80% of patients are admitted from the OR or ED. A list of patients to be admitted is sent during the night.
2. The night nurse checks in CareWeb for what information has been gathered by the OR or ED. CareWeb is also checked for the other 20% of patients coming from home. Physicians are paged upon admission of a new patient.
3. Upon entry to the department, the patient or patient’s parent must fill out a Functional Health Pattern Assessment Form (Appendix P-2). This four-page form is filled out every...
time a patient visits. Some questions are sensitive and are asked in private by the nurse directly to the patient. Nurses regularly ask for non-standard medications. Physicians also interview the patient to verify pertinent information. Physicians sometimes ask about non-standard medications.

4. Usually a resident writes prescriptions and an attending physician signs off on them. The physician assumes all medications from previous services have already been cancelled and he or she rewrites all orders.

5. The pharmacist calls the physician if he or she sees an error in the physician order or has a question to clarify.

6. After the physician prescribes a set of medications, the nurse to administer these medications for the first time will double check for errors. The nurses also sit in on rounds so they are informed of the patient’s condition directly from the physician, and are made aware of what medications a patient should be getting.

7. Medications are given at the bedside and record is kept on an MAR. Another copy of the MAR is kept in the Med Room. The Med Room MAR is solely a reference for medication gathering ease and no notations are made on it. Each night pharmacy sends two updated MARs for each patient to the department. The night nurse compares the bedside MAR to the new one to make sure all medications are carried over properly and new orders appear correctly. The nurse puts one of the new MARs at the bedside file and uses the other to replace the Med Room MAR.

8. Upon exit of the patient from the unit, Functional Health Pattern Assessment and MARs are sent to medical records.

Issues Arising with the Current Process

- Medication history and allergies recorded on the form are available on the bedside file for the entire time a patient is in the unit. However, information is never recorded in CareWeb.
- Allergies are updated in CareWeb but are never seen in pharmacy. This situation occurs in all departments that update CareWeb, because CareWeb never uploads back into the pharmacy system, WORx.
- A physician voiced a concern that residents don’t always have a good sense of brand name versus generic drugs and don’t always recognize double dosing.
- In children, different medication resources recommend different doses. Some physicians are used to other resources than the floor standard Lexicomp guide, which may create dosing errors.
- Handwriting is also an issue and may result in calls from pharmacy.

5.2.1.2 Pediatric Otorhinolaryngology

The project team interviewed a Clinical Nurse II. Findings are reported below.

Current Process. The current patient and medication information flows in the outpatient clinic of the Pediatric Otorhinolaryngology are as follows. (Please refer to the flowchart in Appendix E-2 for an illustration of the following description.)

1. A patient is referred to the clinic and makes an appointment.
2. Upon the first visit, the patient or the patient’s parent fills out an Outpatient Note Form (Appendix P-2), which asks about medical history and current medications and allergies.
3. A nurse or physician reviews the information and may ask for more clarification.
4. Nurses do not specifically ask for non-standard medications but uses phrases such as, “What do you take everyday?” Some nurses report that asking such questions will adequately cover the subject.
5. The physician makes notes on a different Outpatient Note Form (Appendix P-2).
6. The physician also dictates findings into the CareWeb PSL.
7. Both forms are sent to medical records at end of the patient’s visit.
8. Upon the patient’s return visit, he or she does not fill out the medical history form again.

**Issues Arising with the Current Process**
- When a patient returns for a visit, the clinical nurse must request the medical history form be sent from medical records. This usually takes longer than the visit, so this record is usually not seen every repeat visit. The physician may ask for any pertinent information but no record is kept of a changed medical history or medication record.
- The home medication list is not updated upon each visit.
- Information gathered on the medical history form is not recorded anywhere in CareWeb unless it is pertinent to a diagnosis and is mentioned in the PSL.

**Areas for Improvement and Waste Reduction.** The Peds Oto system lacks adequate communication from other departments. No mechanism exists to verify or update incoming medication information. Outgoing communication works well because the physician updates the PSL, and other departments can read the updated information. However, an improvement would be to keep the home medication and allergy lists in a central accessible location such as CareWeb update them after every visit.

### 5.2.1.3 Pediatrics Infusion

The project team interviewed two Clinical Nurses from in the Pediatric Specialty Clinics within the Taubman Center. Findings are reported below.

**Current Process.** The current patient and medication information flows that occur in the outpatient clinics of Pediatric Infusion are as follows. (Please refer to the flowchart in Appendix E-3 for an illustration of the following description.)

1. The infusion area receives an order from a physician to administer a certain IV prescription to a patient for a specified number of visits. This order may be updated between administrations as the patient visits his or her physician for follow-ups.
2. The pediatric infusion area faxes the received prescription to the infusion pharmacy the day before the patient is scheduled to come in, so pharmacy can prepare.
3. Because the IV must be mixed just before the infusion, the nurse calls the pharmacy when the patient is about to arrive to notify the infusion pharmacy about making and delivering the prescription.
4. All the patients that come in are already in CareWeb. Nurses check in CareWeb for any necessary patient information.
5. When the patient comes in, the nurse does a final screening, which involves asking the patient “how are you feeling?” and “anything new?” Sometimes the patient’s parents are interviewed instead. However, talking to the patient directly is how nurses obtain most of their information.

6. After the infusion, the nurse sends the results and information to medical records.

**Issues Arising with the Current Process**

- If a concern arises, the nurses can put a note in CareWeb or send the patient’s physician an email.
- The nurses do not need to ask the patients about their medical and medication history when they come in. They are simply administering a prescription and they assume that the referring physician has already gone over the patient’s medical and medication history before writing the prescription.
- Nurses occasionally may have old information about what medication the patient is supposed to receive.

**Areas for Improvement and Waste Reduction.** A need for a better system of documenting prescription changes between patient visits arises from a lack of direct communication between the clinical nurses and the patient’s physician.

**5.2.1.4 Pediatric Intensive Care Unit (PICU)/Pediatric Transitional Care Unit (PCTU)**

The project team interviewed the Clinical Nurses. Findings are reported below.

**Current Process.** The current patient and medication information flows in the Pediatric Intensive Care Unit (PICU)/Pediatric Transitional Care Unit (PTCU) are as follows. (Please refer to the flowchart in Appendix E-4 for an illustration of the following description.)

1. In the inpatient area, patients are received from other floors or from outpatient referrals.
2. If the patient is an outpatient, the physician and nurse ask the patient about his or her medication history.
3. The patient’s parent fills out a Functional Health Pattern Assessment Form (Appendix P-2).
4. The nurses do not check CareWeb for patient medication history; however, the physician will routinely check CareWeb for history.
5. Nurses occasionally ask patients about non-standard medications.
6. If the patient is an inpatient, he or she is transferred from the OR or from another floor.
7. The physician reviews the patient’s medication history with the patient and checks files that are delivered along with the transfer of the patient.
8. If patients come from another floor, an MAR is sent with them and prescriptions are not re-written because the level of care does not change.
9. The physicians may review the patient’s medications if they would like to make a change.
10. If the patient comes from the OR, the physician re-writes the medications and the information is sent by paper with the patient or verbally from the OR. If the patient comes from the ED, the physician must re-write the medications and the information is faxed. Communication does not occur through a computer system.
11. The nurse doublechecks the new orders with the previous department’s orders from the old MAR.
12. Each night, the night nurse receives an updated MAR and adds it to the patient’s file.

**Issues Arising with the Current Process**

- The usage of CareWeb is non-standardized. One nurse reported using it often and prefers using it over the bedside MAR to verify current medications. However, another nurse reported not knowing that the information was available online.
- New MARs may not reflect all the medications a patient is on, necessitating the nurse to look for old MARs.

**Areas for Improvement and Waste Reduction.** Nurses may be unaware of technology available to them to better organize patient charts and information. They reported encountering occasional difficulties in communicating information to and from other departments. However, upon the suggestion of CareWeb, they responded that it creates an “extra” step that they do not need.

**5.2.1.5 Mott Post Anesthesia Care Unit (PACU)**

The project team interviewed a Clinical Nurse III. Findings are reported below.

**Current Process.** The Mott PACU is responsible for both the pre- and post-anesthesia care for children at UMHS. The current patient and medication information flows in Mott PACU are as follows. (Please refer to the flowchart in Appendix E-5 for an illustration of the following description.)

1. When a child patient is scheduled for surgery, the patient’s parents are called by the coordinating nurse the day prior to surgery. Since the patient is a minor, the parent or guardian is asked what medications the child is currently taking.
2. While taking down relevant information during the phone call, the information is cross-checked with the patient’s medication history in CareWeb. At this time, the patient’s guardian is informed as to what medications the child can and cannot continue taking until surgery.
3. When the patient arrives the next day at the PACU, the guardian bringing the child is asked to verify the questions asked the day before on the telephone. This step checks to make sure that the parent or guardian did not forget to identify a drug that the child is taking, or if a different parent or guardian brings the child to the hospital, this step verifies that all the information has been provided and is consistent.
4. An Anesthesia Questionnaire (Appendix P-2) is filled out by the patient’s parent or guardian when the patient arrives at the unit for admission.
5. A second nursing form (Appendix P-2) is used by the hospital staff. The hospital staff’s form has three points for documenting the current medication use of a patient. One area is filled out by a nurse during the phone call, and the other two are filled out by a nurse and physician (not necessarily the surgeon) when the patient arrives.
6. Both forms follow the patient to surgery and are sent to medical records when the surgery is complete.
Issues Arising with the Current Process

- No updates are made to CareWeb documenting the medications that patients are given.
- Pre-surgery information obtained via CareWeb may not always be accurate and the PACU nurses reported they cannot directly update incorrect or outdated information. Children’s medications may change often, which could lead to errors if CareWeb is not up-to-date.
- No interaction with the patient’s primary care physician outside of UMHS takes place to verify any new or discontinued medications.

5.2.1.6 Pediatric Cardiology Catheterization Lab

The project team interviewed a nurse practitioner. Findings are reported below.

Current Process. The current patient and medication information flows in the Pediatric Cardiology Catheterization Lab are as follows. (Please refer to the flowchart in Appendix E-6 for an illustration of the following description.)

- For inpatients, the medication orders are written and sent to pharmacy.
- For outpatients:
  1. A nurse checks CareWeb before the patient comes in.
  2. It was reported that the patient is called 99% of the time before the procedure. During this call, the nurse confirms the information on CareWeb. If there is a concern about medications, the patient is asked to bring his or her medications in when he or she comes for the procedure.
  3. The yellow Admission Day of Procedure or Outpatient Procedure form (Appendix P-2) is filled out. The list of medications on this yellow form is then copied to the “Sedation Analgesia Record.”
  4. After the procedure, the new list of medications is written on the Discharge Summary and Instructions form (Appendix P-2).
  5. The medication orders are written up and sent to the pharmacy.

Issues Arising with the Current Process

- If patients are referred, their profiles are not in CareWeb, and a call can be made to the surgery office to get the patient’s information.
- It was reported that CareWeb is not updated after the procedure because of insufficient time and repetition of information on paper forms and CareWeb.
- If there ever is a concern about information being accurate, the patient is the first person that is asked.
- The patients are only asked what vitamins they are taking if they are going to be put on medications that may interact.
- Concern that there is not enough space allotted for writing medications on the various forms was expressed.

Areas for Improvement and Waste Reduction. A recommendation is to emphasize the importance of updating CareWeb. Also the use of online forms would reduce the time and repetition involved with filling out paper forms.
5.2.1.7 Holden – Neonatal Intensive Care Unit (NICU)

The project team interviewed a registered nurse. Findings are reported below.

Current Process. The current patient and medication information flows in the NICU are as follows. (Please refer to the flowchart in Appendix G-1 for an illustration of the following description.)

1. When a newborn is admitted to the NICU, the mother’s medical history is reviewed in CareWeb to determine if any of the information is helpful in diagnosis.
2. The night nurse is responsible for reconciling the MAR with the actual order slips. An example order slip is included in Appendix P-1. This is to ensure that the newborn receives the medication at the proper time as well as the correct dose. If there is an error, a new order is written and sent to the pharmacy for proper updates on the next MAR.
3. Before the start of a nurse’s shift, the oncoming nurse should double check that the night nurse properly reconciled the MAR.
4. On average, newborns will remain in the NICU for about 14-30 days; however, some newborns will remain in the NICU for up to 1 year. When the newborn leaves the NICU, the information regarding the medication the child is taking is given in paper form to the primary pediatrician.

Issues Arising with the Current Process
- Medication reconciliation was reported not to be a large issue in the NICU. This is because the patients are newborns with no previous medical history.
- Since few drugs play a role in the newborn’s diagnosis, the mother’s information is rarely included with the chart of the newborn.
- If necessary, the nurses consult WatchChild to view relevant patient information if the mother was a patient in the UMHS. Otherwise, the nurse can have a conversation with the primary care physician. This usually lacks the transmission of pertinent patient information.
- No information is updated electronically for the child’s permanent record in regards to the patient’s medication history.

Areas for Improvement and Waste Reduction. The current system is repetitive in terms of information transfer in order to update the MAR. The inability of the nurses to update this information in an efficient manner increases the possibility that a change may not be made. This may result in an inaccurate dosage to be administered at an inappropriate time. It is important that the information be accurate and that all medications are administered properly because of the fragile state of newborns in the NICU.

5.2.1.8 Women’s Birth Center/Obstetrics

The project team interviewed a Clinical Nurse and the Clinical Care Coordinator. Findings are reported below.
Current Process. The current patient and medication information flows in the NICU are as follows. (Please refer to the flowchart in Appendix G-2 for an illustration of the following description.)

1. When the clerks in the triage receive a call that a patient is coming in, they go onto CareWeb and print off the patient’s basic information. The Birth Center also has its own software system, WatchChild, which is frequently checked when the patient is admitted.
2. When the patient arrives, either the family members or the patient are asked what medications the patient is currently taking. This information is documented on the Triage Note (Appendix P-3). A nurse also asks the husband or escort to fill out a Functional Health Pattern Assessment Form (Appendix P-3).
3. If the patient is from Corner Health Center, Planned Parenthood, or a family practitioner, then they will send over the patient’s paper chart. Midwives bring their own information with them. These patients are not in WatchChild.
4. Rarely a patient may need to go to the Operating Room. In this case, the medication information is sent with the patient’s chart.
5. After the delivery the newborn’s profile is created in CareWeb. He or she is also documented into WatchChild.
6. During the patient’s stay a Hypersensitives Form (Appendix P-3) that contains all the patient’s medications, foods, and allergies that could potentially interact with new medications is filled out. It flags any issues the physicians and nurses need to know.
7. When the patient is discharged a nurse fills out a Discharge Summary form (Appendix P-3) which contains all medications received and prescribed for the patient. A physician also fills out the Post-Partum Orders form (Appendix P-3) and sends this information to the pharmacy.
8. The patient then goes to his or her primary physician for follow up care.

Issues Arising with the Current Process
- The mother’s information on CareWeb is not updated after the delivery.
- The Birth Center is mainly a walk in clinic so there is not much time between when the clinic is told patient is coming to when the patient gets to triage.

Areas for Improvement and Waste Reduction. The process in the Women’s Birth Center involves many forms. Reducing the number of forms may allow for simpler methods in reconciling patient medications. Additionally, WatchChild is going to be replaced by TraceVU, which is likely to be more compatible with other systems. It may be possible to have CareWeb linked to TraceVU.

5.2.1.9 Family Medicine

The project team interviewed the Assistant Chair of the Department of Family Medicine. Findings are reported below.

Current Process. The current patient and medication information flows in Family Medicine are as follows. (Please refer to the flowchart in Appendix G-3 for an illustration of the following description.)
- New patients:
1. The patient’s profile is checked in CareWeb.
2. The physician asks the patient what allergies he or she has and updates the Problems Summary List (PSL) in CareWeb.
3. The physician asks the patient if he or she needs any refills. Upon giving new prescriptions, the physician gives a list to the patient describing what the medications are for and how to take them.
4. The physician updates CareWeb with new medication information.
   - **Transfer patients:** The patient’s referring physician is asked to send the chart to the clinic. The chart is usually not available for the first meeting so the patient fills out a Patient Information Sheet (Appendix P-3) when he or she comes in.

**Area for Improvement and Waste Reduction.** It is easy to make data entry errors in the PSL because it is free text. Items on the list can be duplicated, creating confusion.

### 5.2.2 Psychiatry

#### 5.2.2.1 Child Psychiatry

The project team interviewed a registered nurse. Findings are reported below.

**Current Process.** The current patient and medication information flows in Child Psychiatry are as follows. (Please refer to the flowchart in Appendix F-1 for an illustration of the following description.)

1. A child is admitted to the Child Psychiatry department in one of three ways:
   - Psychiatric Emergency Room (75%)
   - Consulting Service (20%)
   - Direct Admission (5%)
2. A formal admission process involving a social worker, teaching staff, psychiatrist, and a physician takes place. They interview the child and the parent separately and ask many questions, including what medications the child is currently taking. If the patient arrives at a time outside of the regular business hours when a treatment staff team is not available, basic questions would be asked on admission including current medications, and the formal admission process would convene for this patient during the next business day.
3. This information is then reconciled with any information received from the area which sent the patient to Child Psychiatry.
4. If more information is needed, the treatment staff team usually contacts the outpatient provider to get a previous medical history and medication list. With that list, the medication’s impact on the patient would also be noted.
5. Since the patients are minors, the parents are required to sign a waiver (Appendix P-4) allowing the psychiatric department to administer certain drugs to their child. Before this waiver is signed or any drugs are administered the parents are informed of the possible side effects and the process by which the drug works. Parents are informed both verbally and with written documents. If the parents are not available, verbal consent by phone is allowed if a non-biased third party witnesses and listens to the call.
6. The night nurse is responsible for reconciling the MAR against the chart. Corrections would be made and signed off. Some nurses re-reconcile their patient’s MAR before the beginning of their shift. When the nurses administer a drug to a patient, they use the following procedure:
   - Check the patient’s wristband
   - Ask the patient for his or her name and birth date
   - Verify this information with the MAR
   - Administer the medication and sign off what time it was administered.

7. Every day during a child’s stay in this department there is a treatment team meeting that discusses a child’s performance or side effects while on certain drugs. The multi-representative team is able to notice changes in many different aspects of the child’s life. At this point a physician may vary the dose or change the medication a child is on.

8. When a child is being prepared for discharge, the nurses teach the family and the patient how to take the drug, how often, and to be aware of any dangerous side effects. This information sharing increases the knowledge of the patients and allows the parents to be aware of what the child will need to take at home.

Issues Arising with the Current Process
- In the Psychiatric department all psychotropic drugs are required to have signed consent forms (Appendix P-4) from the parent. Michigan Mental Health Code requires this consent. This code however does not govern any non-psychiatric departments, which would thus allow a nurse in Mott children’s hospital to administer these drugs without parental consent.
- A lack of extensive communication between the psychiatric department at UMHS and the patient’s primary care physician exists; this may result in medications prescribed by the physicians at UMHS not being continued by the family physician.
- The use of electronic resources by the staff in the Child’s Psychiatric department is rare due to the confidential nature of a child’s psychiatric treatment. The information that is entered into CareWeb is not shared with any other departments through the use of a firewall that blocks other users from having access to this information. The firewall keeps all information confidential.
- An emergency Omnicell machine is available as a safety line due to the dangerous side effects of the drugs that nurses are administering to the patients. The drugs need to be readily available for necessary treatment.

Areas for Improvement and Waste Reduction. The process for tracking medication is reported by staff to be cumbersome. A large number of necessary safety checks are done to ensure that the proper medications are being administered. The nurses reported that they need a reliable future system that ensures safety, but also allows medication to be administered in a timely manner. One reason for delays in getting medications is that the hospital does not carry all the drugs that are being prescribed and the medications may take a few days before they are brought to the hospital. Also, a concern with possible miscommunication in use of verbal orders over the telephone needs to be addressed.

When patients leave the hospital, sometimes they are admitted to another hospital or even to another location within UMHS. The information about the child’s stay in psychiatry cannot be
shared unless it is pertinent to the child’s or staff’s safety. The chart can only be shared with other departments if the parents are willing to sign a consent form. If the consent is not signed, it is split into two parts: general care and psychiatric. The psychiatric part is removed from the rest of the chart and filed. This is a concern because not all the medication information is passed on to other departments.

5.2.2.2 Adult Psychiatry

Most patients are admitted through the Psychiatry Emergency Department. About 10-20% of the patients come from a consult liaison service. A small percentage of patients come from direct scheduled admissions.

The project team interviewed a Registered Nurse. Findings are reported below.

**Current Process.** The current patient and medication information flows in Adult Psychiatry are as follows. (Please refer to the flowchart in Appendix (F-2) for an illustration of the following description.)

1. The “Patient Report” (Appendix P-4) intake form is filled out when a patient arrives.
2. CareWeb is checked to see if the patient has been in before. Most patients have been admitted before. If the patient has been to other hospitals or clinics then that information is gathered as well. The patient must sign an “Authorization to Release” (Appendix P-4) form in order for the hospital to gather this information.
3. The patient’s outpatient physician is called if he or she has one.
4. Prescriptions are written on slip orders and are picked up by the pharmacy. Every night, a nightshift nurse reconciles the patient’s MAR with copies of the slip orders.
5. When the patient is discharged, the “Psychiatry Discharge Note or Follow-Up Orders” (Appendix P-4) form is filled out by the physician.
6. The patient is informed about how to take his or her medications and the side effects. Sometimes a copy of the patient’s information on CareWeb is printed out and given to the patient to take home.

**Issues Arising with the Current Process**
- Errors still occur in the MAR, but this is a rare problem.
- CareWeb is generally only checked when the patient is first admitted and when he or she is leaving.

**Areas for Improvement and Waste Reduction.** The interviewees stated that they would have no problem switching to a completely computerized medications system. They expressed that the current system works fairly well, but it would be more ideal to be fully computerized.

5.2.3 Adult Procedures Units

Adult Procedures includes the Medical Procedures Unit (MPU), Radiology, and the Cardiac Procedures Unit (CPU).
5.2.3.1 Medical Procedures Unit (MPU)

The project team interviewed the Associate Manager of the MPU. Findings are reported below.

Current Process. The current patient and medication information flows in the MPU are as follows. (Please refer to the flowchart in Appendix H-1 for an illustration of the following description.)

1. When the patient enters the MPU, he or she fills out the “Pre-Procedure Health Questionnaire” (Appendix P-5), which asks about medication and allergy histories.
2. The nurse reviews this questionnaire with the patient and checks for specific medications that can interfere with the procedure. The nurse sometimes consults the Printed Medical Record (PMR) from CareWeb.
3. If a “red flag” exists, the nurse consults with the physician and the procedure might not continue. If no red flags exist, the physician conducts a short patient assessment regarding information on the questionnaire and, if the physician feels confident that the procedure can be carried out safely, he or she treats the patient.
4. Once the procedure is complete, the physician writes a report and updates the Problem Summary List (PSL) with current medications in CareWeb.

Issues Arising with the Current Process
- CareWeb PMR is not always reliable because it does not contain the most updated medication list. Therefore, the nurse or physician does not always use it.
- Because of the lack of reliable information in CareWeb, the patient is the primary source of information regarding medications. However, patients are not always sure about (1) what medication(s) they are taking and (2) what information is relevant to share with the health care provider.
- Once the procedure is complete, the physician does not usually update the PSL in CareWeb because of time constraints.

Areas for Improvement and Waste Reduction. The main challenge that MPU faces is lack of a standardized procedure with which to obtain an accurate medication history and to deliver updated medication information to the next care provider. Additionally, physicians may lack the time necessary to update the PSL. Therefore, the MPU must rely on a patient’s ability to accurately recall and report the medications he or she is taking.

5.2.3.2 Radiology

The project team interviewed the Clinical Nursing Supervisor and a clinical nurse. The findings are reported below.

Current Process. The current patient and medication information flows in Radiology are divided into the outpatient and the inpatient sections as follow. (Please refer to the flowchart in Appendix H-2 for an illustration of the following description.)

- Outpatient:
  1. The nurse calls the patient two days before the appointment to gather the medication information by using the phone triage questionnaire. The nurse also asks the patient to
bring in his or her medications. Otherwise, the questionnaire is completed upon arrival (Appendix P-5).

2. The night nurse compares the triage information with the medical history on CareWeb before the visit.
3. The nurse verifies the information with the patient upon arrival.
4. A multi-page form (Appendix P-5) is used to record the triage as well as what medications were given during the procedure.
5. After the procedure, this form is sent to medical records.

- Inpatient:
  1. The nurse fills out a form for past medical history. The physician consults this form.
  2. The night nurse looks up patient information on CareWeb one night before the procedure, and calls the unit for clarification.
  3. The patient comes down for the procedure with their MAR, which shows when medications were last given. Patients from the Intensive Care Unit (ICU) sometimes come down with a nurse who is well informed about their medication condition.
  4. Medications given in Radiology before, during, and after the procedure are recorded on the same form as the medical history.
  5. After the procedure, the form is faxed to the referring floor and the original is sent to medical records.

**Issue Arising with the Current Process.** It is difficult to contact the outpatients before they come in, which leads to uncertainty in the current medications.

### 5.2.3.3 Cardiac Procedures Unit (CPU)

The project team interviewed the Nursing Supervisor of the CPU. Findings are reported below.

**Current Process.** The current patient and medication information flows in the CPU are as follows. (Please refer to the flowchart in Appendix H-3 for an illustration of the following description.)

1. The patient goes into the Prep area when admitted into the CPU.
2. The nurse fills out the “Pre-Procedure Assessment” on the “Cardiac Procedures Unit Nursing Flowsheet” (Appendix P-5) by:
   - Outpatient: The nurse interviews and asks the patient to write down their medication list.
   - Inpatient: The nurse consults the MAR.
3. During the procedures, the nurse fills out the “Procedure Notes” on the “Cardiac Procedures Unit Nursing Flowsheet” (Appendix P-5). The nurse also enters the medication information into the CPU computer systems: MacLab (CAD lab) and EPRS (EP lab).
4. After the procedures, the patient is transferred to the recovery area. The nurse fills out the “Post Procedures” on the “Cardiac Procedures Unit Nursing Flowsheet” (Appendix P-5).
5. When the patient gets discharged,
   - Inpatient: The medication record is transferred back to the unit.
• Outpatient: The medication information is transferred to the Shadow Chart (folder) and to the Medication Record where the physician dictates the procedure findings and medications given, which is transcribed into CareWeb. The nurse prepares the “Post Procedure Patient Instruction” (Appendix P-5) forms, which includes the medication information for the patient.

**Issues Arising with the Current Process.** In practice, some of the following issues arise:

- The inpatient nurse may send the wrong patient’s MAR with the patient. This causes the CPU nurse to go through the patient’s chart for the information, which can be time consuming.
- It was reported that the nurse may avoid consulting CareWeb for medication information, particularly for the outpatient, because the information can be incomplete or inaccurate.
- Sometimes, the patient does not give the full medication list that he or she takes at home, for example diet pills.

**Area for Improvement and Waste Reduction.** The main challenge that the CPU faces is the lack of a complete and accurate source of patient medication information.

### 5.2.4 Emergency Department (ED)

The project team interviewed the Supervisor Clinical Nurse of the ED. Findings are reported below.

**Current Process.** The current patient and medication information flows in the ED are as follows. (Please refer to the flowchart in Appendix I-1 for an illustration of the following description.):

1. When the patient enters the ED triage, he or she is assigned to a priority number (from 1 to 5) based on the severity of injury or problem and pain level. (1 - most severe; 2 - breathing difficulty and pain level at 8 or above; 5 – least severe)
2. If patient’s priority number is 1 or 2, he or she is sent to the exam room at once. If patient’s priority number is 3 – 5, he or she is sent to the staging area if rooms are unavailable.
3. In the staging area, the nurse gathers information on the patient’s current illness (history of current illness; chief complaint; pain score; vital signs; visual acuity; and consciousness) and medication history (information on allergies; name of home medications, excluding vitamins, herbals, or dosage of medications; immunizations; past surgical instances; reproductive history; and communicable diseases) from the patient, the patient’s family, and CareWeb (sometimes). Information would also be obtained from EMS, Survival Flight, or other air services depending on the state of arrival.
4. The nurse assesses the patient’s physical condition and enters relevant information into Centricity.
5. When an exam room is available for priority 3-5 patients, the physician reviews the patient’s file in the CareWeb (if it exists) or verifies it with the patient before he or she sees the patient.
6. In the exam room, the nurse fills out the event flowsheet in Centricity with the list of medications given per event (for priority 1 – 5 patient).
7. The physician prescribes medication.
8. The nurse documents the prescription medications in Centricity CIV.
9. The nurse takes the medication directly from the Omnicell machine and administers it.
10. If a patient is not transferred to other units, the nurse will continue to administer the medications ordered before unless there is new order. If a patient is transferred, an ED nurse will send a hard copy of the Centricity CIV report (can be accessed via CareWeb) with the patient.

**Issues Arising with the Current Process**
- No update is done to CareWeb PSL. The patient’s information is entered into Centricity during the entire stay.
- Medications in this unit are ordered by physicians. Information is not transferred to pharmacy. As a result, the use of a medication is based on physicians’ knowledge only; there is no pharmacist to check for medication interactions.
- Most of the time, it is difficult to obtain a patient’s med history. It was reported that a majority of the medication histories obtained are incomplete.
- Nurses from other units are not familiar with Centricity CIV. Therefore, they may not use Centricity as a source of patient medication information.

**Areas for Improvement and Waste Reduction.** The main challenge that ED faces is use of a separate computer system from the rest of the hospital (Centricity). As a result, it is necessary to integrate various systems into one that could serve everyone’s needs. Additionally, communication between different systems could be enhanced. For example, if a nurse is not familiar with Centricity, it would be helpful if the nurse could somehow transfer the information from Centricity to a system that he or she is more familiar with.

**5.2.5 Adult Inpatient Units – Nursing Perspective**

The project team interviewed nurses from the following adult inpatient units:

- 4B/C Thoracic Vascular
- 6D Medical Intensive Care Unit (ICU) – Central Staffing Resource (CSR)
- 5D Surgical ICU
- 6A Adult Physical Rehabilitation
- Trauma Burn Center
- 7A General Clinical Research Center
- 7DS Hemodialysis

The following is a description of the interview findings from Inpatient Nursing.

**Current Process.** Based on discussions with the individuals listed above, the inpatient nursing units share similar medication reconciliation process, with some differences by unit. The general flow of medication information to and from adult inpatient units is as follows. (Please refer to the flowchart in Appendix J-1 for an illustration of the following description.)
1. When a patient is admitted to a unit, the nurse interviews the patient and obtains medication information. The nurse may also consult the previous care providers, family members, as well as information in the patient’s chart and possibly CareWeb. The nurse uses information obtained from various sources to fill out an intake form (e.g. the Functional Health Pattern Assessment Form (Appendix P-6)).

2. If the patient transferred from another unit, the nurse reviews orders given in the previous unit and confirms that the medications given are consistent with the information obtained from the patient interview and other sources. If there is a discrepancy, the nurse will consult the patient’s physician.

3. The physician assesses the patient and prescribes medications to be administered in the unit. He or she fills out strip orders which the nurse or clerk will pull and send to the pharmacy.

4. After sending the strip orders, the nurse on duty will fill out a temporary Medication Administration Record (MAR) with all medications to be given to the patient for the next 24 hours.

5. The nurse will administer medications at the appropriate times as listed on the MAR, and will then note on the MAR the actual time of administration.

6. At the end of each shift, the nurse is responsible for comparing the MAR with physician orders in the chart to make sure nothing on the orders was missed.

7. At a shift change, the nurse leaving will give a verbal one-on-one report to the nurse coming on duty so he or she is up-to-date on the patient’s status and any changes in care (including some medication information).

8. At night, pharmacy sends a pre-printed MAR to the inpatient unit which includes all medications to be administered in the next 24 hours. The night nurse is responsible for reconciling the MAR with the physician orders (in the patient’s chart). If there is a discrepancy, the nurse will send new orders to pharmacy and handwrite any changes on the MAR so the correct medications will be given.

9. Throughout the day, if the physician prescribes new orders, the nurse will handwrite the new orders on the MAR and send those orders to the pharmacy. Since each nurse consults the MAR before administration, any new medications will be given assuming the MAR is updated.

10. If the patient is transferred to another unit, the nurse will fill out a Nursing Transfer Summary (Appendix P-6) which describes the patient’s health status. If the patient is discharged, both the nurse and physician fill out discharge forms (Appendix P-6). The patient will be sent home with a discharge form and any prescriptions he or she needs.

Deviations from the Current Process. Although most of the units studied follow roughly the same general process described above, there are some exceptions due to differences in care requirements in the various units. Some findings that are inconsistent with the above description are listed below:

- **5D SICU**: Most of the time, medication information will be obtained prior to entry in the SICU (e.g. in the ED or Pre-Op).

- **6A Adult Physical Rehabilitation**: In this unit, nurses do not usually ask the patient for all of his or her home medications; they check the “See Admitting H&P per MD/NP/PA”
box on the Functional Health Pattern Assessment form because home medications would not normally be administered unless ordered by physicians.

- **4B/C Thoracic Vascular:** This unit keeps two copies of the MAR – one in the “Med Room” and one at the patient’s bed.

- **Trauma Burn**
  - Nurses use Centricity to obtain and update patient information. When a patient enters the Emergency Department (ED) and is subsequently transferred to Trauma Burn, medication information is available on Centricity for other nurses to view. Trauma Burn nurses may try to fill in empty boxes in a patient’s profile in Centricity, but usually only view the profile.
  - Because of their familiarity with Centricity, Trauma Burn nurses do not consult CareWeb very often.
  - Physicians are expected to check the MAR everyday (before writing orders) to make sure the patient’s medications are correct.

**7DS Hemodialysis**
- This unit serves both inpatients and outpatients.
  - For both types of patients, a Dialysis Run Sheet is used to document any medications given during dialysis. A copy of all run sheets is kept in a patient’s “local” chart.
  - If the patient is an inpatient, medications given in dialysis are noted on the Dialysis Run Sheet and the patient’s MAR. (It was reported that writing medications given during dialysis on the MAR is a new policy and nurses are beginning to get used to doing this.) A copy of the run sheet is also placed in the patient’s hospital chart. After seeing an inpatient, the UMHS Hemodialysis unit will send the last three run sheets to the patient’s chronic dialysis provider (outside UHMS).
  - If the patient is an outpatient, a copy of the run sheet is sent to medical records.

- Most prescriptions are obtained mainly through “physician-to-physician” contact; strip orders are not written for each patient, and consequently, a pharmacy review is not always done before medications are given to the patient.
- Medications are obtained from pharmacy on an as-needed basis only.
- Patients are not discharged from this unit; they are sent back to their “home” unit (inpatients) or are outpatients.

**General Issues Raised in Inpatient Nursing Units.** Based on the information collected, the general concerns or issues that were raised in more than one unit are categorized as follows:

- **Inconsistencies in Obtaining and Transferring Patient Medication Information**
  - Inconsistent practices are being used to obtain and transfer medication information, as can be seen in Figure 6.
  - Some potentially useful sources of information, such as a patient’s local pharmacy, are not often consulted.
  - It was reported that some units are using outdated forms.
It was reported that the use of Discharge Navigator ensures physicians update the PSL right away. However, none of the inpatient nurses interviewed mentioned the use of Discharge Navigator.

Use of inconsistent methods could result in a loss of information.

![Sample period: February – April 2005 Sample Size: 8](image1)

![Sample period: February – April 2005 Sample Size: 7](image2)

**Figure 6.** Inpatient nurses reported using different sources for (a) obtaining and (b) transferring patient medication information.

- Inconsistent use of CareWeb: Nurses do not consistently consult CareWeb. At least two of the interviewees mentioned that nurses may not be aware of the amount of functionality and information provided by CareWeb. In general, inpatient nurses may
view but do not have access to update CareWeb. They depend on physicians to update the PSL and pharmacists to update the Inpatient Med Profile. Only 63% of nurses interviewed said they use CareWeb as a source of patient medication information. One nurse reported that newer versions of intake forms have a spot that says “See PSL,” reminding nurses to check the CareWeb Problem Summary List for patient medications. However, this section may not be on older versions of forms.

- **Reconciliation of MAR with Physician Orders**
  - Three of the seven units claim that orders are missed or lost sometimes because either the nurses do not reconcile and update the MAR or the pharmacy somehow misses the order.
  - If a new order is written and the order is lost, it will not show up on the next day’s MAR and the medication will be missed.
  - If a physician places many new orders on a nurse’s flow board and does not write the time on them, it is sometimes difficult to determine which orders are current. The nurse reported that it is confusing when one sheet says to discontinue a medication and another order says to change the dose.
  - If the nurse is simply reconciling one MAR with another (instead of with the physician’s orders), any mistakes on the pre-printed MAR from pharmacy may not be detected.
  - The current system depends on the night shift nurse to reconcile the physician orders with the MAR. However, if the night nurse failed to find out the mismatch or errors on the MAR, the errors would be perpetuated from one MAR to the next.
  - In addition to the night nurse reconciling the pre-printed MAR from pharmacy, it was reported that each nurse is supposed to reconcile the MAR at the end of his or her shift to ensure no orders have been missed. However, only 4 of 5 nurses asked about this reported reconciling at the end of each shift. Also, the UMHS Adult Inpatient Medication Administration policy states MAR reconciliation is to occur every 24 hours, indicating a possible misunderstanding of the policy.
  - Only the past 24 hours of orders are reconciled, which might allow an order to be missed.

- **Communication Barriers**
  - If the administration time of a medication is changed and pharmacy is not informed, this information will not be reflected on the new MAR and, consequently, patients may end up missing doses or getting a double dose.
  - Physicians may give an intern a verbal order to change a medication, but he or she might forget to actually write down the order.
  - Patients who arrive to Trauma Burn, ICU, or SICU may be unconscious and, as a result, are unable to answer medication information questions. Therefore, nurses and physicians must consult family members or make their own assessments of what medications the patient should be taking (e.g. blood pressure medications may be needed if blood pressure is unusually high).
  - Upon discharge, patients are often unclear what medications they are going home on, and what they are for.
• Nurse Education
  o Some nurses reported that they did not receive sufficient training on how to carry out the MAR or physician order reconciliation process. No standard procedure to follow when the two documents do not agree has been adequately communicated to the nursing staff. This issue was mentioned particularly by the Central Staffing Resource (CSR).
  o As mentioned, many nurses are not aware of all the features of CareWeb. This may be because (1) nurses have not been trained to use CareWeb, or (2) they do not see a need for it.

• Lead Time
  o Three of the seven units think that the time delay between when a new medication is prescribed and when the change appears on the MAR is too long. One interviewee reported that this delay could be 30-45 minutes long. During that time, if a nurse is administering the medications listed on the previously reconciled MAR, he or she might end up giving the changed or discontinued medications.
  o When pharmacists are unsure of an order that has been sent to them, they need to page the physician to confirm the order. This may take a long time and delay the administration.

• Waste in the system: Two out of seven units think that the system is not efficient:
  o Some nurses think the process has too many steps:
    Physician writes the order → Nurse or clerk pulls the order → Nurse or clerk sends the order to pharmacy → Pharmacy processes order and sends up medication or makes available in an OmniCell → Nurse administers the medications
    Procedures could be simplified and waste eliminated in this process.
  o Others say the reconciling process is thorough but time consuming.

• Physicians’ Handwriting: Three out of seven units mentioned that the handwriting on the physicians’ orders is hard to read. This makes the reconciliation of orders difficult and could lead to errors. However, the Medication Safety Coordinator reported that the statistic is as low as two reports per year.

Issues Raised in Individual Units. In addition to general issues raised in inpatient nursing, specific concerns were also reported:

• Central Staffing Resource (CSR)
  o Some nurses did not receive a detailed training from the Educational Service for Nurses (ESN) on how to carry out the MAR reconciliation process.
  o There is no standard written reconciliation procedure when the MAR and the orders do not reconcile. Experienced nurses know what to do, but new nurses may not and eventually incorrect processes may develop.
  o Nurses from CSR find it difficult to reconcile the MAR with the orders that are older and not easily accessible.
• 4B/C Thoracic Vascular Unit
  o Floor 4’s pharmacy closed recently so now floor 4 must use the floor 5 pharmacy. Some think that pharmacists are overworked as a result.
  o Because physicians do not always mark the day of administration on weekly medications, Pharmacy is forced to assume the day of administration is the day the order is sent. The daily MAR will therefore show a weekly medication scheduled on, for example Wednesday, but it is actually not due until Friday. As a result weekly medications may be forgotten.

• Trauma Burn
  o When a patient is switched from Intensive Care section to the General Care section within this unit, most of the time orders are not re-written by the physicians. Nurses have a hard time determining which medications should be continued and which should be discontinued.
  o In this unit, each patient has a computer along the bedside. Nurses recommend the use of computers to perform the ordering process electronically. By doing so, the lead time could be reduced. The use of computers to review the current patient information along the bedside before nurses administer the medications could allow them to obtain up-to-date information, and thus reduce errors.

• 6A Adult Physical Rehabilitation.
  o It was reported that nurses sometimes do not ask all of the information on the Admission Questionnaire.
  o It was also reported that nurses think that the current system works because there are several people checking the system (night nurses and pharmacy).

• 7A General Clinical Research Center: Nurses are not always asking about non-standard medications (e.g. herbals and over-the-counters). As mentioned earlier, 52% of all staff surveyed are not asking about non-standard medications.

• 7D Hemodialysis – Outpatient: Any medication given during dialysis is not available on CareWeb, but only on the Dialysis Run Sheet and MAR. However, outpatients do not have a chart and so the medication information may be lost to other departments unless they know where to look for it.

Areas for Improvement and Waste Reduction
• The accuracy of CareWeb should be improved to gain the trust of existing users. Additionally, standardized training should be given to nurses to make sure that they are familiar with the use of CareWeb in order to retrieve information efficiently.
• The use of a standardized and accurate computer system could reduce the lead time as well as the waste in the system. This would also eliminate the physician handwriting issue and reduce the loss of orders when they are sent to the pharmacy. Implementing the Orders Management Project (OMP) would greatly help in this area.
• Standardized education should be given to nurses on the policy for reconciling the MAR with physician orders. In addition, a demonstration of the process and an explanation for the reasoning behind it could help nurses carry out the procedure more consistently and
effectively. The importance of reconciliation in patient safety should be emphasized so nurses understand the significance of the process.

- Standardized processes for obtaining and transferring patient medication information should be created and enforced so as to prevent loss of vital medication information. Additionally, patients should be consistently educated on their medications at discharge. One nurse recommended the use of an extra step during discharge (either on a paper form or in Discharge Navigator) that involves the nurse reconciling the pre-admission medications with the inpatient medications, and clarifying them with the patient.

5.2.6 Internal Medicine – Physician Perspective

Internal Medicine includes both the Inpatient Unit and Outpatient Clinic.

5.2.6.1 Inpatient Unit

The project team interviewed the Clinical Instructor and Director. Findings are reported below.

Current Process. In the inpatient unit of Internal Medicine, most of the patients admitted are transferred from the Emergency Department (ED) and a small percentage of them are from other clinics. The steps of medication flow and reconciliation are as follows. (Please refer to the flowchart in Appendix K-1 for an illustration of the following description.)

1. Prior to a patient’s admission, the internal medicine resident or intern retrieves the most up-to-date patient medication list from CareWeb, the discharge summary from a prior admission, or the Problem Summary List (PSL).
2. Using the printed medication list, the resident subsequently verifies its accuracy by interviewing the patient.
3. The resident generates an admission report of the current medications for the physician. The report consists of a comprehensive list of various medications such as over-the-counter (OTC) drugs, prescription drugs, herbals and vitamins.
4. When new medications are ordered, the inpatient medication list of each patient is updated by the physician every morning and the MAR is printed every night.
5. Physicians verify that the medications on the physician order list are found on the MAR every morning; they add any missing medications to the MAR.
6. During transfer (i.e. inpatient to Intensive Care Unit or vice versa), the patient’s current medications are forwarded through physician meetings; a transfer note is written on the patient chart and nurses update the patient’s MAR.
7. At discharge, residents add intended medications to be taken after discharge into the PSL (either the outpatient list or the current hospitalization list) or the MAR.

Issues Arising with the Current Process

- Reliance on patients for complete verification of medications may give rise to errors; patients are not always aware of their current medications.
- Multiple sources of patient medication information may give rise to errors. It was reported that most of the medication reconciliation errors are errors of omission that occur 5% of the time (i.e. medications do not appear on CareWeb).
• Residents use non-standardized written admission cards for each patient (i.e. each resident has his or her own list of medications to be reconciled with patient).
• New medications to be administered are handwritten on MAR, causing possible handwriting issues and inconsistencies with the electronic inpatient medication list.
• The MAR is printed once a day and may not be complete when retrieved in between printing.
• Verbal communication of medication information is susceptible to errors.
• When home medications are discontinued upon patient admission, they may be forgotten to be restarted at discharge.

Areas for Improvement and Waste Reduction. In order to counteract errors due to incomplete medication reconciliation with patients, there is a need to stress to patients the importance of keeping an up-to-date medication list. This could be done by sending reminders through e-mail or regular mail prior to admission. Continuous improvement could also be established by educating the public through slogans on the UMHS website and flyers. With regard to increasing effectiveness of medication reconciliation in the inpatient unit, admission cards could be standardized across all residents and interns. This would allow a complete set of patient medications to be reconciled, minimizing errors of omission. Improvements to the recall of patient medications upon discharge could also be made by reconciling with the admission cards when discharge medications are ordered. This would allow patients to continue with their pre-admission medications if needed.

5.2.6.2 Outpatient Clinic

The project team interviewed the Medical Director of Taubman General Medicine and Clinical Assistant Professor. Findings are reported below.

Current Process. The Internal Medicine Clinic is usually busy and no pre-visit patient interview is conducted. The steps of medication flow and reconciliation are as follows. (Please refer to the flowchart in Appendix K-2 for an illustration of the following description.)

1. The physician prepares a patient’s medication list and the PSL before seeing the patient.
2. The physician asks the patient about his or her current medications taken at home as well as his or her up-to-date medication list.
3. Upon assessing the patient and writing prescriptions, the physician records the prescriptions by writing notes in the CareWeb PSL and medication list through dictation. The addition of notes in the PSL may be overlooked. When the physician realizes that the notes are dictated to the medication list but not to the PSL during the next patient visit, he or she specifies the addition of the notes to PSL.
4. The physician requests that each patient write down and keep a list of all new medications ordered; however, this process is not consistent across all physicians and not every patient keeps a list of personal medications.
5. During a patient transfer, the next care provider retrieves all up-to-date medications from the medication list or PSL from CareWeb; this extrapolates any errors in previous entries.
Issues Arising with the Current Process

- CareWeb can be accessed and modified by various personnel; once the medication list is changed, the physician loses information about the medications ordered in the past. A history page can be accessed, but it is reported that the information is difficult to use and poorly organized.
- It was reported that CareWeb is complicated to use:
  - The medication list consists of multiple pages and is tedious to read.
  - Non-standard medications such as herbals and over-the-counter drugs are not well-documented.
- Insufficient patient awareness of keeping up-to-date personal medication lists exists.
- A patient’s medication list is often not detailed enough (i.e. incomplete information on drug dosage, frequency, how long taken etc.).
- A large proportion (reported 5-10%) of errors result from failure to communicate new medications and additional important information such as dosage and frequency back to the patient.

Areas for Improvement and Waste Reduction. In order to reduce the frequency of medication reconciliation errors in the Internal Medicine outpatient clinic, target the primary source of all medication information - the patient. As stated in the ‘Areas for Improvement and Waste Reduction’ section of the inpatient unit, UMHS heighten the importance of keeping a personal medication card to every patient. In addition, the interviewed physician suggested that each patient in UMHS be given a ‘UM patient medication card’. Such a standardized system would enable patients to update their current medication card every time they are administered new medications. With regards to retaining patients’ medication history in CareWeb after each new medication is ordered, Dr. Tichenor recommended a layout similar to the table below:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Date 1</th>
<th>Date 2</th>
<th>Date 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>XYZ</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

5.2.7 Pharmacy

Pharmacy includes the Infusion Pharmacy (Cancer and Geriatrics Center), Inpatient Pharmacy, OR Pharmacy, and Outpatient Pharmacy.

5.2.7.1 Infusion Pharmacy – Cancer and Geriatrics Center (CGC)

The project team interviewed a CGC pharmacist. Findings are reported below.

Current Process. The main responsibility of the pharmacists in the CGC is to prepare infusion medications according to physician orders and they interact primarily with nurses for chemotherapy preparations. The pharmacists’ main database is WORx. The steps of the medication flow and reconciliation process are as follows. (Please refer to the flowchart in Appendix L-1 for an illustration of the following description.)
1. The physician or nurse faxes medication orders to the infusion pharmacy; the orders are written by the physician on a standardized template.
2. If the ordered medications are unclear, the pharmacist reconfirms them with the corresponding physician.
3. The pharmacist ensures appropriateness of the written faxed order by reviewing the patient’s medication list in WORx.
4. The ordered medication information is entered into WORx.
5. The pharmacist attaches the corresponding medication label to an order sheet for pharmacy technicians to prepare.

**Issues Arising with the Current Process**

- Faxed orders are sometimes unclear and therefore difficult to read.
- Occasionally faxed orders do not reach the nurses and pharmacists; both personnel require one copy of each order.
- Inconsistencies arise in checking of patient medication histories; pharmacists do not have time for direct patient verification.
- The current medication list in CareWeb sometimes does not include home medications.
- Also, the current medication list does not include chemotherapy given in the clinics.
- WORx does not interface with CareWeb for the CGC infusion outpatients.

**Areas for Improvement and Waste Reduction.** Due to the occasional illegible faxed orders, the CGC should consider alternative ways of transmitting medication orders. An option would be the trial switch from faxed orders to scanned orders placed in a database such as CareWeb. The clarity of the orders could be improved with this alternative. Both nurses and pharmacists would then be able to print out copies of the orders for themselves. As the current medication list on CareWeb does not include a section for home medications, an suggestion would be the addition of such a category to the database.

**5.2.7.2 Inpatient Pharmacy**

The project team interviewed the Interim Manager of Inpatient Operations and Strategic Project Coordinator for Pharmacy Services. Findings are reported below.

**Current Process.** Based on the information gathered from the above pharmacy personnel, steps of medication flow and the reconciliation process are stated as follows. (Please refer to the flowchart in Appendix L-2 for an illustration of the following description.)

1. The inpatient pharmacy clerk gathers strip orders from the various floors every hour; the 6th floor pharmacy receives the orders via fax. Orders may be tubed to Pharmacy if it is urgent.
2. When medication orders are received, the pharmacist checks for accuracy of dosage and potential allergic reactions of medications.
3. The pharmacist enters new medication order information into WORx.
4. When a dose or interaction alarm in the WORx system is set off, the pharmacist calls the physician to verify and correct the alarm.
5. The inpatient medication profile in CareWeb and the Omnicell machine is automatically updated with the new medications entered into WORx.
6. WORx automates the delivery of medications to the unit in which the patient resides; this is done through the Omnicells and the Rxobot (a robot that automatically fills prescriptions).

7. Pharmacy is not directly notified when a patient is transferred to another unit. Transfer is assumed by the pharmacist when new orders for all the patient’s current medications are received at one time. During patient transfer, the pharmacist receives the updated prescriptions and verifies them with patient information in CareWeb.

All dispensing of medications by pharmacists are based on orders written by physicians. Prior to writing the orders, the physician verifies the new medications with the patient’s up-to-date home medication list. This process is followed in order to determine the home medications the patient has to continue taking upon admission. Pharmacists also have access to CareWeb when checking for a patient’s home medications. However, this step is not carried out consistently due to the non-standardized free text format of home medications in CareWeb.

**Issues Arising with the Current Process**

- A Pharmacist must review all medication orders before medications may be given. In an emergency, a nurse may override the pharmacist review to gain quick access to medications locked in an Omnicell machine.
- Patients’ home medications are entered into CareWeb in free text form by the physician; free text may contain errors and may be unreliable as patients are sometimes not aware of medications taken at home.
- Faxed orders do not get transmitted to the pharmacists on certain occasions.

**Areas for Improvement and Waste Reduction.** The inconsistency of patient home medication reconciliation is the result of non-standardized home medication information in CareWeb. This is because such information is normally entered as free text by the physician and is often inaccurate due to patients being unaware of their medications. This issue could be relieved by enabling a more standardized system for entering patient home medications. In addition, it could be UMHS’s continuous goal to stress the importance of patients keeping up-to-date medication lists. The issue of missing faxed orders could be solved by adopting a more reliable form of transmission such as scanning and sending orders via email. If economically feasible, an alternative would be setting up a tube system for transporting important order information.

5.2.7.3 **OR Pharmacy Services in UH**

The project team interviewed the Pharmacy Supervisor. Findings are reported below.

**Current Process.** The UH Operating Room (OR) pharmacy is situated centrally in the OR unit with services it provides directed completely to the OR. The main medications obtained from the pharmacy are infusion and antibiotic medications for patients entering surgery and during their recovery stages. The steps for medication flow and reconciliation from the pharmacist’s perspective is as follows. (Please refer to the flowchart in Appendix L-3 for an illustration of the following description.)
1. When a surgery is scheduled, the physician fills out the “Preadmission or Preprocedure Physician’s Orders” (“green sheet,” Appendix P-7) which lists medications required for surgery.

2. One copy of the order is sent to the pharmacy (faxed or delivered a few days to a month in advance).

3. Each day, the OR pharmacy receives a schedule of procedures to be carried out the following day (one schedule is received by 10-11 AM; the schedule is updated by 2 PM).

4. The pharmacist manually reconciles orders on “green sheet” against the schedule.

5. When a patient’s allergies are not listed on the orders, the pharmacist contacts the physician to verify; the pharmacist consults the patient’s CareWeb profile for allergy and other relevant information if a profile is present.

6. If pharmacist has doubts concerning other factors of the drug such as dosage information, he or she contacts the physician to ensure safe administration.

7. When the date of surgery is not stated in the order, the order is kept in an expendable file for thirty days. The pharmacist checks the file everyday to see if any patient on the schedule of surgeries has medication orders in the file; when surgery is rescheduled, orders are re-written.

8. The pharmacy dispenses medications into the Omnicell or holding area for the nurse to retrieve and administer to the patient at the appropriate time.

9. During the recovery stage (post-operation), medication orders are sent to and filled by the pharmacy if it is open; medications are obtained from the 6th floor pharmacy after the pharmacy closes at 4 PM.

10. When a patient gets admitted to his or her next unit of care (i.e. nursing unit), medication orders are written by the physician and are sent to the general pharmacy upon transfer; a WORx and CareWeb patient profile is created in the process.

OR outpatients do not hold a profile in CareWeb or in WORx. Hence, medication order information on the “green sheet” is not entered into WORx. When a “special” or “serious” medication is ordered, the pharmacist enters the medication information into WORx and looks for potential allergic reactions and dosage information. An example of such a drug is that used during a transplant operation.

**Issues Arising with the Current Process**

- Pharmacists do not usually enter information of medications administered during surgery into any computer database unless it is a serious medication.

- If someone wanted to find out what medications a patient was given, he or she would have to look in Centricity under “Anesthesia/Inter-Op” section or look at the patient’s chart.

- Orders for medications to be taken at the patient’s inpatient unit are sent to the pharmacy only when the patient enters that unit; a time lag of 2-3 hours was reported, during which the medication orders are sitting in the chart unprocessed while the patient is in recovery.

- Patient allergies and date of surgery are not always written on the orders; rescheduled surgery orders are not written every time.

- On certain occasions, nurses obtain medication from the Omnicell before sending the order to the pharmacy.
Areas for Improvement and Waste Reduction. In order to build up a reliable database of outpatient medication profiles in WORx, both inpatient and outpatient medication information could be entered into the WORx system. Additionally, Centricity could somehow be connected to WORx. This would ease the process of retrieving patient medication information from Centricity. To reduce the time lag associated with the inpatient pharmacy receiving post-operation medication orders, the OR pharmacy could help start the process while patients are waiting to be transferred to the nursing units from the post-operation rooms. This would help to speed up the ordering process.

5.2.7.4 Outpatient Pharmacy

The project team interviewed the Staff Pharmacist. It was reported that approximately 20% of discharged patients use the outpatient pharmacy. Findings are reported below.

Current Process. The current patient and medication information flows in the Outpatient Pharmacy are as follows. (Please refer to the flowchart in Appendix L-4 for an illustration of the following description.)

1. The outpatient pharmacy receives discharge prescriptions from the discharging floor by phone, tube routing, or patient delivery. Upon receipt the order is stamped and logged.
2. An order entry clerk is in charge of tracking down insurance. If a patient uses prescription coverage, the insurance company will have a good record of their medication history. It is at this time that the clerk often finds “double dosing,” in which a patient is receiving a new prescription for a medication he or she is already on, because insurance companies generally will refuse to pay for the second dose.
3. If there is a problem with the insurance the physician is called to work out an alternative solution.
4. The prescription then goes to a pharmacist or tech to fill. If a tech fills it, a pharmacist must sign off on it. The pharmacist will print the patient’s medication profile from WORx and compare it to their discharge meds to verify drug names and dosages. The physician may be called to verify.
5. When the prescription is filled, the pharmacy will call the floor or page the physician to tell the patient that the order is ready.
6. Patients must go to pick up the medications themselves and electronically sign for them when they leave. This is for insurance purposes.

Issues Arising with the Current Process

- Sometimes there is a gap in communication of medications being prescribed by the discharge physician and patient.
- There is reconciliation between medications given in the hospital and the discharge medications. However, the pharmacists are not looking for forgotten meds, and the only check they have on new medications is if they “look okay.”
- Besides the insurance company, there is no checking process to determine what medications the patient may still have left at home. The patient may already have medications from the last time he or she filled the prescription. This may lead to overdosing if a patient doesn’t realize he or she received a refill, especially if it is a different brand of the same drug.
• Insurance companies will notify the pharmacy if a patient has filled the prescription too often.
• If the patient asks for instructions on how to take the medications then the pharmacy instructs him or her.
• Sometimes the order that the pharmacy receives is different from what the patient was expecting to get.

**Areas for Improvement and Waste Reduction.** Pharmacists should have access to a patient’s complete and accurate medication history so they can better inform patients if they are receiving the same drugs they have at home. Since nothing is entered into the computer, there are no automatic flags about adverse interactions as in the inpatient system WORx. Such a function of signaling adverse interactions should be created.

### 5.2.8 Discharge and Post-Discharge Coordination

UMHS provides services for patient to receive care and guidance at home by nurses after discharge. The project team interviewed three entities from this area, including Discharge Planner, Michigan Visiting Nurse (MVN), and HomeMed.

#### 5.2.8.1 Discharge Planner

The project team interviewed the Practitioner Management Coordinator of the Practitioner Management Discharge Planner. The findings are reported below:

**Current Process.** The current system is documented as follows. (Please refer to the flowchart in Appendix M-1 for an illustration of the following description.)

1. The discharge planner obtains the patient’s medication list from CareWeb, Discharge Navigator, and the physician problem summary.
2. Upon discharge, the Discharge Planner assesses if the patient needs any extra services at home (from MVN).
   2.1 If not, the patient is discharged.
   2.2 If yes, the procedures are as follows:
      a. The discharge planner compares the patient’s medication lists from the nursing summary, the physician problem summary, and the pharmacy’s prescriptions. If a discrepancy is found, the planner consults the physician.
      b. The discharge planner completes the “Physician’s Plan of Treatment Continuing Patient Care Form”, which includes the current medications and those that the patient receives at the hospital.
      c. The discharge planner faxes the form to MVN, and arrange for MVN service to the patient’s home.
      d. The discharge planner follows up with the patient after discharge if there is any problem.
Issues Arising with the Current Process

• If the discharge planner updates the medication list after consulting with the physician (in the case of discrepancy in the patient’s medications), the pharmacy is not informed of the changes.

• The discharge planner cannot access MVN’s system to obtain the most update medication list.

Area for Improvement and Waste Reduction. The challenge is how to obtain and update the most accurate list of the patient’s medication.

5.2.8.2 Michigan Visiting Nurse

The project team interviewed the Director of Patient Care Services and the Director of Quality Management. The findings are reported below:

Current Process. Based on the interviews, the current system is documented as follows. (Please refer to the flowchart in Appendix M-2 for an illustration of the following description.)

1. Before the nurse visits the patient at his or her home, the nurse receives the patient’s current medication sheet from the office. This sheet is prepared by the Discharge Planner at the hospital, and has a “medication box” which tells the nurse what medications the patient is currently taking. MVN can receive the patient’s medication information from other sources as well, for example HomeMed.

2. The nurse asks the patient to verify the medication list; if there is confusion, the nurse calls the physician.

3. The nurse can update the medication list by either of the following methods:
   • Noting down on a laptop, which is linked to MVN’s computer system, called McKesson Pathways
   • Noting down on paper, which would later be transcribed by another nurse at the office onto McKesson Pathways

4. McKesson Pathways can do some medication checks for adverse drug reactions and dosage.

5. Before the medication order is sent out to the hospital, nurse reviews all orders and checks for “dramatic” medications, and would consult the physician if necessary.

6. Once the order arrives at the hospital, it needs the physician’s signature for approval. Then the medication list is updated on CareWeb.

Issues Arising with the Current Process

• The medication list that the nurse has is not always complete.
  o Another physician at another hospital might prescribe more medications.
  o The patient might purchase more medications after the visit.
  o The “medication box” on the form states “See discharge medication list at home” or appears blank.

• The patient does not know the complete list of their medications.

• The nurse does not have a standard checklist for the patient’s current medications.
• If the nurse needs to consult the physician or obtain the signature for the order to be approved, there is a “multi care providers” issue. The physician does not want to sign for the medication that he or she did not order.
• It was reported that CareWeb generally takes ten days to update (after the order is approved). The lag time is a problem if the patient gets re-admitted to the hospital during this time. The medication list on CareWeb would not be updated.

Areas for Improvement and Waste Reduction. The main challenges that MVN faces are the lack of a standard source of a patient’s medication list, and the lag time before CareWeb is updated.

5.2.8.3 HomeMed

HomeMed provides infusion (intravenous) medications for patients at home and those transitioning from hospital to home. The project team interviewed the Pharmacy Service Supervisor. The findings are reported below:

Current Process. Based on the interviews, the current system is documented as follows. (Please refer to the flowchart in Appendix M-3 for an illustration of the following description.)
1. The pharmacist gets the patient referral from a physician.
2. The pharmacist obtains the patient medication list from DigiMedix (WORx), CareWeb PSL, and interviews with nurses. Then the pharmacist compiles all sources into the medication list, which is compared with the list of medications that HomeMed will provide.
3. The pharmacist consults with the patient to finalize the medication profile. This profile includes medication provided by HomeMed and other sources. It is also maintained and updated as long as the patient is with HomeMed in the form of paper chart.
4. The pharmacist contacts the patient periodically (depending on the conditions) to update all medication information. He or she usually asks for Rx, OTC, herbal, holistic therapy, home remedies, etc.

Issues Arising with the Current Process
• The HomeMed pharmacist does not always have access to the discharge planner’s report, resulting in lack of a patient’s discharge medication list.
• Other UMHS units have no access to the HomeMed medication profile because it is paper-based, so the patient is responsible for informing the next care provider about the medications given by HomeMed.

Areas for Improvement and Waste Reduction. The main challenge that HomeMed faces is that it exists as a separate entity that cannot always gain access to a patient’s discharge medication information; nor is its information easily accessed by other care providers.

5.2.9 Operating Room (OR)

The project team interviewed the Clinical Nurse Specialist of UMH-PACU (Post Anesthesia Care Unit) and a Clinical Nurse III (OP or AP coordinator). The findings are reported below:
**Current Process.** The current medication reconciliation process occurs as follows. (Please refer to the flowchart in Appendix N-1 for an illustration of the following description.)

1. One night before the procedure, the nurse telephones the patient by using the “Preoperative Phone Call” sheet (Appendix P-7) to advise the patient on certain behaviors i.e. what medication to take, etc.
2. Three types of patients are seen here: outpatient (OP), admission day patient (ADP), and inpatient (IP).
   - **OP:** The patient was seen in the clinic in the last thirty days. The patient’s medication history should be in the “History and Physical” (H&P) page in CareWeb. If it is not in CareWeb, the nurse can fill out a paper H&P form.
   - **ADP:** The outpatient is planned for admission after surgery.
   - **IP:** The patient’s medication list is obtained from the MAR and the chart. Regardless of what type of patient enters the OR, the nurse would check the complete documents in the patient’s file, including the surgical H&P and the operative consent. If it is incomplete, the nurse would consult the H&P page in the documents folder in CareWeb.
3. The patient or family member fills out the “Patient Information Report” (Appendix P-7) which contains information about the patient’s history and conditions. This information is used to determine if the patient needs to see the anesthesiologist or not.
4. The surgeon or the designees fills out the “Preadmission/Preprocedure Physician’s Order Form” (Appendix P-7) to order medications.
5. The nurse reviews the “Preoperative Teaching Record” with the patient.
6. The nurse fills out the “Preoperative Nursing Care Assessment” (appendix P-7), which includes the allergy and medication information.
7. If needed, the patient sees the anesthesiologist in the preoperative area, where the anesthesiologist will interview the patient and conduct a physical assessment. With the aid of the available forms and the nurses, the anesthesiologist enters all patient information into Centricity, which can be viewed by the nurses and surgeons (although they usually consult the paper forms).
8. During the procedure, the nurse fills out the “Perioperative Nursing Care Assessment” (Appendix P-7) form, which contains the medication and order information.
9. After the surgery, the patient is transferred to the PACU.
10. If the physician would like to prescribe medications, he or she must write all orders (cannot resume medication for IPs or ADPs). All medication orders are written for the inpatient postoperative orders.
11. At discharge:
   - **OP:** The surgeon orders new medications and the primary care physician orders the “resumed” or new medications for patients.
   - **IP or ADP:** When the patient is ready to be transferred to an inpatient unit, the nurse prepares the “PACU Report” (Appendix P-7), which provides information on what medications were given during surgery and in the PACU. Only important home medications are noted – for example, if the patient is diabetic. The report is faxed or communicated verbally through the telephone to the patient’s unit.
Issues Arising with the Current Process

- The nurse does not ask for dosage information during the patient interview.
- No standardized means of communication exists between the nurse and the surgeon; the nurse expects the surgeon to know the patient’s medications.
- There is no standardized way to obtain a patient’s most accurate medication history. It was reported that the accuracy of electronic sources (i.e. CareWeb) is doubted. The nurse only consults the H&P page, which sometimes is not available. The nurse does not ask the patient to bring in his or her medications because the medications might be lost during the process, and are usually expensive. The unstandardized information flow affects the information flow in the OR computer system.
- Most documents are paper-based.

Areas for Improvement and Waste Reduction. The interview findings raised the issue of the use of many forms, resulting in a many paper documents. This leads to a fragmented information flow.

5.2.10 Ambulatory Care

The project team interviewed the Nurse Manager of Rheumatology and Allergy Reichert, the Spine Program and Clinic Director and a medical assistant at Physical Medicine and Rehabilitation and The Spine Program, and a Clinical Nurse III at the East Ann Arbor Health Center.

5.2.10.1 Rheumatology and Allergy Reichert

Current Process. The following steps outline the medication flow and reconciliation steps that occur in the clinics. Unless otherwise stated, most of the steps listed below are carried out by medical assistants (MAs). (Please refer to the flowchart in Appendix O-1 for an illustration of the following description.)

1. A patient’s medication history is printed from the PSL before his or her arrival to the clinic.
2. Upon arrival, the patient is asked for his or her most up-to-date medications in order to verify with the list from the PSL.
3. If the medications do not match, the MA clarifies with patient and notes are made on PSL.
4. The physician sees the patient and re-confirms the medications.
5. The physician corrects medication discrepancies in DMI (Documented Medication Information) or in the PSL.
6. The physician writes orders for new medications to be administered; the PSL is not updated. Vaccines administered are documented in CareWeb under the Immunization Registry; not in PSL.
7. The nurse attends to phone calls from patients regarding the order or refill of a certain medication.
8. The nurse calls the pharmacy directly for the medications to be dispensed.
9. Newly-dispensed medications are documented in the PSL or on the nursing note (both are part of CareWeb).
Issues Arising with the Current Process

- Medication information is inconsistently updated in both the “local medical record” and the main patient chart.
- It was reported that medication documentation in PSL or CareWeb is usually incomplete.
- The nurse is usually unaware of the dosage for a particular medication re-fill; he or she has to verify with corresponding physician.
- Sometimes patients are unaware of the current medications they are taking; despite the reminder on the appointment slip in the mail, patients forget to bring in a list or bottles of their medications.
- The lack of knowledge of insurance-covered medications causes patients to call back for alternative covered medications; this causes delays and inconveniences nurses and physicians.

Areas for Improvement and Waste Reduction. The key issue to focus on is the non-standardized use of CareWeb, particularly the PSL. Its improvement would lead to the removal of step 3 in the current system, thus reducing waste in the process flow. As the patient remains the primary source of accurate medication information, improvements should be directed to increasing patient awareness of keeping accurate medication lists.

5.2.10.2 Physical Medicine and Rehabilitation (PM&R)

Current Process. The general flow of medication information to and from PM&R is as follows. (Please refer to the flowchart in Appendix O-2 for an illustration of the following description.)

1. When a patient arrives, he or she is asked to fill out the intake form (Appendix P-8) or a detailed history form, depending on the clinic he or she is in.
2. If this is the patient’s first visit, he or she will not have an existing profile in CareWeb. The medical assistant (MA) will first look at the DMI in CareWeb and print out a copy of the PSL.
3. The MA verifies the list of medications with the patient and asks for any changes since last visit. The MA will write the changes on the printed copy of the PSL and update it after the visit.
4. The physician sees the patient and prescribes prescriptions if necessary.
5. If the prescription is given to the MA, the MA will update the PSL with the new medication information after the patient’s visit; if the prescription is given directly to the patient, the physician is responsible for updating the PSL.
6. Patients can get their prescriptions filled in two ways:
   1) From an external pharmacy
   2) By calling the Med Refill Line (This hotline allows patients to call the clinic for refills of their current medications.) MAs will regularly check this system and call in a patient’s desired medications to any pharmacy to save the patient time.

Issues Arising with the Current Process

- When doctors were primarily responsible for updating the PSL, medical transcriptionists would often type the words “Update to PSL” instead of actually updating the PSL; consequently, physicians were sometimes hesitant to say “Update to PSL.”
• Now, MAs have the primary responsibility for updating the PSL and it was reported that this system is working; physicians will often sign off on MAs’ updates anyway. The only issue arises when MAs do not receive prescriptions because they are given to patient directly from the physician and the physician may or may not update the PSL right away.

• In using the Med Refill Line, patients sometimes don’t want to wait 24-48 hours for medications to be processed. If a patient is requesting narcotics for pain control, the MA cannot re-order them without consulting the physician; this can create a time delay if the physician is unavailable and other physicians are unwilling to sign off on such serious medications.

• Some physicians are more slowly adapting to using the computer systems than others. However, the physicians are provided with laptops and wireless internet, and are beginning to take advantage of the full functionality of CareWeb.

Areas for Improvement and Waste Reduction. The interviewees expressed a clear satisfaction with the current system of medication reconciliation in the PM&R unit. Having MAs update the PSL saves the physician times and allows updates to be immediately visible to the rest of UMHS. However, a standardized procedure should be enforced for physicians to review MAs’ updates and to make changes to the PSL in the cases where the MA is not involved (e.g. when new prescriptions are given to patients). Additionally, physicians should be encouraged to become more comfortable with making electronic updates; for instance, the interviewee reported that the use of CareWeb to print out prescriptions allows for automatic updates to the PSL. Clearer communication between the medical transcriber and the physician should also be fostered to increase physicians’ confidence in the accuracy of the system. Finally, the issue of how to handle serious requests from patients using the Med Refill Line when the physician is unavailable should be addressed.

5.2.10.3 East Ann Arbor Health Center

The East Ann Arbor Health Center consists of five clinics:

• Adult Medicine and Pediatrics
• Family Medicine
• General Medicine
• General Pediatrics
• Obstetrics and Gynecology

All of the patient examination rooms contain computers to allow for nurses and physicians to have a direct interface with the computer systems while treating the patient. This is advantageous for physicians and nurses to be able to update the PSL or to use scriptwriter to prescribe medications for the patient.

Of all the clinics at the EAA Health Center, the interview findings suggest that the Family Medicine clinic uses the most comprehensive procedure for reconciling medications. Therefore, a detailed description of how medication information is reconciled in this area follows, along with a description of how processes in the other clinics differ from that of Family Medicine.
Current Process. The following is a summary of what happens when a patient is seen at the Family Medicine clinic. (Please refer to the flowchart in Appendix O-3 for an illustration of the following description.)

1. When the patient checks in, a copy of the PSL is printed and placed with the patient’s file for easy reference.
2. The medical assistant (MA) pulls up a patient’s CareWeb profile on a computer in the exam room. The information is then reconciled with the patient to validate its accuracy. If there is a discrepancy the information is updated immediately.
3. If prescriptions are needed to be refilled, Scriptwriter is used to provide the patient with refill prescriptions.
4. When the provider comes in to see the patient he or she begins by rechecking what the MA has changed on CareWeb.
5. After seeing the patient, the provider will either leave the PSL on CareWeb as is or he will remove or add medications as needed. This ensures that the PSL is up-to-date with all the medications the patient is currently taking.

Deviations from Family Medicine Process

- Adult Medicine and Pediatrics
  - Some providers in this area follow the same procedure as the one outlined in Family Medicine, but others prefer to not use the computers in the exam rooms and do their patient medication reconciliation using paper forms.
  - These providers use the automatically generated printout to mark any cancelled medications or to add new ones.
  - Providers dictate these changes to the transcription department who is then responsible for updating the computer system including the PSL.

- Obstetrics and Gynecology
  - The patients that come to this department are not routinely checked on the PSL to verify the patient’s medications. It was reported that most medications administered in this department are painkillers and have little to no interaction with other medications.
  - It was reported that, depending on the provider, a different process is followed:
    - Some providers may make changes to update CareWeb and the PSL.
    - Some providers may choose to dictate changes.
    - Some providers assume that since the drug will only be taken for a short time there is no need to add the medication to the PSL.
  - Scriptwriter is used in the Obstetrics and Gynecology area for refilling prescriptions for the patients. It is also used for generating new prescriptions if there is a change in the medications being given to the patient.
  - With scriptwriter it is possible to send the order over the phone or via fax to the pharmacy. This decreases the chance for errors and ensures that each patient gets the needed prescriptions filled.

- General Medicine (Internal Medicine)
  - In the General Medicine clinic the patient’s medication information is reviewed using the PSL.
Similar to the previous departments, the use of the computer systems is provider-specific. While some providers prefer to use the computer system, others prefer to do it on paper and dictate updates over the phone.

- General Pediatrics
  - It was reported that children usually take fewer medications than adults.
  - Physicians in this area prefer to use the printed version of the PSL and to update the information using dictation.
  - Instead of dictating the notes themselves, some physicians have allowed a MA or licensed practitioner nurse (LPN) to dictate the notes. The physicians also allow the MAs and LPNs to input the changes for them.

- Pharmacy
  - The pharmacy at EAA has no access to the PSL and relies on the legibility of the prescription to make sure that it is filled correctly.
  - It was reported that the EAA pharmacists prefer to take all prescriptions by fax. This allows them to receive the typed script from scriptwriter, thus reducing errors in trying to decipher handwritten prescriptions.

Areas for Improvement and Waste Reduction
- All providers are not required to follow the same medication reconciliation processes. This allows physicians to perform the task in a method that is most comfortable to them, which is not necessarily the most efficient method in terms of both time and accuracy.
- One reason the interviewee posed for explaining the lack of wide-spread use of computers to track medications in all the exam rooms is that some physicians are not willing to take the risk to log onto a computer and let someone else use it, possibly illegally. The need for physicians not to have to worry about improper use of computers is important in fully implementing a reliable and up-to-date computer system. Another reason that physicians are not willing to become fully reliable on the computer system is the lack of knowledge or trust they have in the system itself. A lack of confidence in the system being 100% accurate was reported. Possible ways to alleviate these problems could be to implement the use of laptops over desktops. This would allow the physicians to have secure log-ins and still keep the information up-to-date and accurate. The physicians would also have to be introduced to all the available features on the computer system and why it would be more advantageous than their current process.

6 Potential Scenarios

Based on our findings regarding the flow of medication information, we have created hypothetical scenarios involving patients moving through the UMHS. These scenarios demonstrate the potential pitfalls of the current non-standardized transfer of medication information.
6.1 A potential allergic reaction

1. An aging patient is being seen in the ER. The patient is having heart trouble and requires a CT scan of the aorta. The CT scan requires the use of a contrast media. The ER physician sends the order to Radiology for the processing of the CT scan.
2. The attending nurse is notified to stop proceeding with the process. The Radiology department has flagged the patient for being allergic to the CT contrast media.
3. The attending nurse and ER physician review CareWeb and Centricity to see what the adverse reaction was and when it occurred. No information is available about the allergic reaction on either of the systems.
4. The nurse calls the Radiology department to try and obtain more information and informs them that the information is not available on CareWeb or Centricity.
5. The physician is hesitant in continuing with the procedure. To continue with the CT scan will require 13 hours for a steroids preparation. When asked about possible allergic reactions, the patient has no recollection of any allergy to the contrast media. However, the physician remains hesitant in continuing until further investigation is done.
6. The Radiology department has a system (RIS) that the patient is logged into when he or she is scheduled for any service performed by the department. A questionnaire is filled out by the patient, which is implemented into the system in code numbers that will cause alerts later in the system. This alert is the one that indicated the allergy of contrast dye to the department. However, the computer file does not keep track of when that information was entered.
7. Knowing that allergy information, the ER physician tries to contact the primary care physician (PCP). The patient is asked for the PCP’s name and is unable to provide it. The other family members with the patient are able to provide the physician’s name and the ER physician pages him. He informs the ER physician that the adverse reaction was nausea and vomiting. The two physicians then discuss using the contrast media since the reaction was a common side effect and not an allergy.
8. This information is all entered into CareWeb. The ER physician and nurse continue with care for the patient as if there was no allergy. Radiology is also informed of the decision.

This scenario shows how the electronic systems are not fully connected and that they are not always reliable. If the ER physician had continued with care without contacting the primary care physician and a serious allergic reaction occurred it would have been a breakdown in the current system because Centricity would have been incomplete and too heavily relied upon.

6.2 A double dose

Note: The drug name used in this scenario is not an actual drug; it is just used to refer to a blood pressure drug in general.

1. The patient is a 57-year-old overweight male admitted to UMHS for chronic leg pain and numbness. He is taking a drug called HBP for his high blood pressure. During admission he tells the physician he is on HBP at home and the physician writes a prescription so he can continue to take it in the hospital. The physician sees in a CareWeb PSL that the prescription was entered by another physician six months ago.
2. The patient stays for four days and upon discharge the physician writes him a prescription for four new medications for his leg pain and decides he will save the patient a trip to UMHS and includes a refill of his home medication HBP. However, the physician writes it for the hospital's generic brand GHBP. The patient doesn't realize that it is the same drug.

3. The patient decides to go to the UMHS outpatient pharmacy to fill his prescriptions instead of waiting until he gets back to his local CVS. The outpatient pharmacy looks up his file in WORx and sees that he is taking home the same medications in the same doses that he was taking as an inpatient. Because the patient doesn't have prescription coverage he pays in cash.

4. He goes home taking a double dose of the same drugs (HBP), but doesn't realize it because they have different names on the bottle.

This scenario emphasizes the importance of having an up-to-date medication profile on all patients moving through UMHS. Here, the outpatient pharmacy had a record of what was taken in UMHS, but did not have access to a list of the patient’s home medications. This could also be solved with better patient education about medications.

6.3 Continued administration of a discontinued drug

1. The patient is a female teenager who was treated in the ER and subsequently was transferred to a bed in the ICU.

2. In the ICU, the patient’s attending physician prescribes an anticoagulant (call it XYZ) to treat her condition. She is also prescribed pain medications.

3. After a day, her condition improves and the anticoagulant is discontinued. The physician writes “DC XYZ” on an order and flags the patient’s chart to alert the clerk that a new order has been written. The clerk is very busy so she asks the nurse to take care of the new order. The nurse is also busy as three patients have just transferred into the ICU and need to be cared for. She makes a mental note to go back and pull the order, but then runs off to a patient’s bedside.

4. Three hours later, that nurse’s shift is over and after a hectic day she leaves without reconciling the patient’s MAR with the physician orders, and neglects to see the flagged chart. Normally this nurse is very diligent about reconciling the MAR and looking for new orders, but the ICU was so busy that day that she barely had a free moment during her shift.

5. The night nurse comes on duty, and it is time to administer the patient’s medications. The nurse consults the MAR, which is at the patient’s bedside. He sees three medications to be given – the anticoagulant (XYZ) and two pain medications. He checks for the right medication, patient, time, dosage, and route and administers the medications.

6. At 3 AM the new MARs come from Pharmacy. The night nurse reconciles the patient’s MAR with the physician’s orders and sees that a certain medication that showed up on the MAR was supposed to be discontinued. However, the order was never pulled. He realizes it was for the anticoagulant he just administered and handwrites the change on the MAR and sends a clarification order to pharmacy, as is policy to do so. He alerts the physician of the missed order and administration of the anticoagulant. The physician watches the patient’s status carefully to see if the drug has a negative effect.
7. In about an hour, the patient experiences internal bleeding. Luckily, since the physician knows the cause (unnecessary anticoagulant), he is able to stabilize the patient.

This scenario shows what can happen with an un-standardized system for order-checking. Luckily, in this case the error was caught soon enough that the patient was stabilized. However, if the night nurse failed to reconcile the MAR, the same anticoagulant may have been administered again, leading to possibly dire consequences. When the OMP is in place, orders will be transferred directly to Pharmacy, eliminating some of the potential for human error. However, the need for MAR reconciliation is essential, as is shown in this potential scenario.

7 Conclusions

The findings from the surveys, interviews, and observations indicate the current state of the medication reconciliation processes in Adult Medical and Surgical Services, and Pediatric, Women’s, and Psychiatry units in UMHS. Based on these findings, it enabled general themes that were mentioned by multiple parties and specific instances of those issues in different units to be highlighted. These are summarized below. To understand specific issues faced by the units, please refer to the micro level findings above, specifically the “Areas for Improvement and Waste Reduction” sections that accompany each unit’s discussion.

7.1 Effective Processes in Use

All of the units had a different method of collecting, updating, and transferring patient medication history. They all had their own procedure to ensure medication reconciliation. Of the areas that we interviewed none reported to have a perfect system, but many had good internal practices. Three areas in particular stood out for effectiveness in different categories: General Pediatrics Inpatient Unit, East Ann Arbor Outpatient Center, and Adult Psychiatry Department.

General Pediatrics Division on the Mott General Care Inpatient Units: Information gathering and internal reconciliation

The General Pediatrics division has a thorough medication information gathering technique.

- First a nurse checks CareWeb for what information other departments have already gathered on the patient.
- Upon admission to the unit (if inpatient) or clinic (if outpatient), the patient or patient’s parent must fill out a Functional Health Pattern Assessment Form. The form is compared with the information available on CareWeb. The patient or patient’s parent is then asked by both the nurse and the physician separately to verify this information, which includes routinely asking about non-standard medications.
- The General Pediatrics staff thoroughly checks and compares all information that is available to them.
- Each day when a physician goes on rounds to the inpatient units, a floor staff nurse accompanies the physician. The nurse makes note of medication changes and the overall condition of the patient. This extra communication directly between the nurse and the physician is a valuable step in medication reconciliation.
• When a medication is prescribed to a patient, the first nurse to give it compares it to the orders the physician gave to the pharmacy and the plans are discussed in rounds.
• Each evening when the pharmacy delivers new MARs, a night nurse reconciles them with the old MARs and the new orders that were discussed in rounds.

East Ann Arbor Health Center: Verifying, updating, and communicating patient medication information

East Ann Arbor clinics have an efficient routine for verifying, updating, and communicating patient medication information.
• When the patient is taken into an exam room, his or her information is pulled up on CareWeb by the medical assistant (MA). The information is then reconciled with the patient to validate its accuracy. If there is a discrepancy, the information is updated immediately.
• The physician then rechecks what the medical assistant has changed on CareWeb. After seeing the patient, the physician will either leave the PSL on CareWeb unchanged or will remove or add medications as needed.
• Because of this practice of verifying and updating records, the EAA clinics have accurate lists on their patients. Also because the list is in CareWeb, it is easily accessible by any UMHS department.

Adult Psychiatry Department: Educating the patient

The Adult Psychiatry Department has effective practices for patient education, which leads to discharge medication reconciliation.
• Through their entire stay in the unit, any time a patient medication is prescribed or updated, a complete medication list is printed from CareWeb and given to the patient.
• Along with the current medication list, specific drug information including other names for the drug, side effects, and possible drug and dietary interactions is also given. The patient always has a clear picture of what he or she is taking.
• Especially upon discharge, patients are knowledgeable of their prescriptions and their importance. Patient education prevents patients from not taking their medications and from accidentally double dosing with a generic brand. Also it makes the patients knowledgeable so they have an accurate list upon their next visit.

7.2 Overall Areas for Improvement and Waste Reduction

Conclusions can be placed under four major categories in order: (1) lack of a standardized system and method for obtaining and transferring patient medication information; (2) communication barriers; (3) staff familiarity with available information systems; and (4) issues involving the Medication Administration Record (MAR) for inpatients. Specific instances and implications of these issues are described below:
Lack of a standardized system and method for obtaining and transferring patient medication information is leading to incomplete and inaccurate information.

- No UMHS-wide medication reconciliation system exists, resulting in the integration of different systems in some departments such as the ED.
- CareWeb is widely used, but it is not consistently updated due to physician time constraints and a lack of inpatient nurse access; this results in a time delay in other units receiving complete and accurate vital patient information.
- A lack of standardized procedures to obtain an accurate medication history and to deliver the updated information to the next care provider exists, leading to redundancies, missed information, and inefficiency.
- The patient usually does not have a complete current home medication list; the patient may not even be aware of what he or she is taking.
- A majority of units surveyed are not asking about non-standard medications, such as herbals and vitamins. However, this information is just as important as prescription drugs.
- A patient might have multiple care providers; UMHS does have access to the medications given by another institution.
- The pharmacist does not generally check the patient’s home medication list. In some cases the pharmacist does not have access to the patient’s pre-admission medication information.
- Some units, particularly the Women’s Birth Center and the Operating Room, use many forms with often redundant information, creating waste.

Unfamiliarity with available information systems and a lack of access prevents some staff from updating medication information.

- Some nurses do not utilize or are unaware of the available information systems, particularly the functionality of CareWeb, resulting in repetitive and inefficient work.
- This lack of use may result from nurses being uncomfortable with CareWeb or computer systems in general, possibly as a result of insufficient training.
- The UMHS data systems are often used as “view only” (61% of the time), preventing updates from being made the rest of the time (39%). This could be due to 57% of the staff not having access (or perceiving they do not have access) to update their systems. A lack of updates causes incomplete and sometimes inaccurate medication information in a patient’s profile.
- A lack of nurse access to update systems such as CareWeb places the burden on the physicians, who experience time constraints that lead to delays in updating important medication information.

Communication barriers between patients, nurses, physicians, and pharmacists result in incomplete or inaccurate information.

- Verbal communication is the most widely used means of transferring patient medication information. However, this may lead to inaccuracies if the information is not written down.
Some units are electronically isolated from other units, such as the Pediatric Otorhinolaryngology clinic, which does not have open communication with other units and therefore does not have a mechanism to verify or update the incoming patient’s information.

If a child is transferred from the Psychiatry unit, the medication list in his or her file cannot be transferred to other units due to privacy issues and a lack of security in available computer systems, resulting in incomplete information.

Communication between inpatient nurses, physicians, and the pharmacists is incomplete and inefficient. For example, sometimes the pharmacist is not informed that a medication has been discontinued, resulting in discontinued medications being sent to the unit.

The current system in the Pediatrics Infusion area within the Taubman Center does not have an information flow from the physician to the pharmacist in the event of prescription change. If the physician changes a prescription for the patient, the pharmacy may not be updated with that information.

Sometimes orders are illegible for both the pharmacy and inpatient nurses reconciling the MAR. Faxes to the pharmacy can sometimes be hard to read.

Patients may know their current medications, but still may not know what they need to share with the care provider recording the medication history.

Information on the Medication Administration Record (MAR) and physician orders may be inconsistent, resulting in the administration of improper drugs or doses.

- The MAR sent from the Pharmacy to an inpatient unit may be incomplete. For example, it might not include new medications or recent changes in administration times.
- When the physician writes a new order, there is a lead time before the changes take effect and the nurse sees it. This lead time may delay the administration of new medications, and possibly result in the administration of discontinued medications.
- The MAR reconciliation procedure is not fully understood by all nurses, for example those from Central Staffing.

8 Recommendations

Based on the conclusions above, various strategies are recommended to reduce inconsistencies in the medication reconciliation processes at UMHS. Suggested improvements are grouped by relative expected costs.

Implement a standardized process for obtaining and transferring patient medication information.

Low Cost Improvements:
- Create and implement a standardized procedure for gathering medication information. Include the questions caregivers will ask, which sources they will gather information from, and how they will record this information. Also include which specific care giver will be doing each step of the process. Gathered information should be stored in a place where it can be easily accessed and updated by multiple departments.
Create a standard method and timeline for updating such a system. In Ambulatory Care units such as the East Ann Arbor Health Center and the PM&R clinics, for instance, the CareWeb PSL is updated each time a patient visits the clinic. This results in instant updates viewable by most of UMHS.

Educate everyone (nurses, physicians, and any care giver that works with the patient) on the new method. To get their support, stress the importance of medication reconciliation on patient safety, and how a standard process will make their jobs easier.

High Cost Improvement:
- Select a UMHS-wide electronic database for entering patient medication information that can be accessed by all UMHS personnel. Consider using a system that already exists, such as CareWeb, which right now 94% of the units are using. To increase utilization, integrate a more user-friendly and standardized interface for recording patient medication histories, such as a pull-down list instead of the free-text Problem Summary List (PSL). The CareWeb PSL is being consistently updated at the satellite locations, and this system is reported to work effectively. For those units not using CareWeb, an information technology initiative could be started to enable a two-way upload of medication information between CareWeb and any other database, thus making CareWeb a complete source of medication information.

Educate nurses and other staff on how and when to use CareWeb and any other relevant systems.

Low Cost Improvements:
- Hold timely training sessions for new and current personnel who work with the systems. These sessions would include information on the efficient use of relevant databases, as well as their association with other databases in UMHS. Attending the sessions would improve the technology knowledge of staff and increase the efficiency of the medication reconciliation process in the long run.
- Distribute handouts or user manuals to supplement the training.
- Once staff is thoroughly trained, the burden of system updates can be shared among physicians, nurses, and other knowledgeable staff. Sharing responsibility makes staff accountable and should ultimately make them more consistent in their use of these systems, leading to more accurate information in a timely matter.
- Grant access to properly trained staff members to update the system.

Eliminate communication barriers between patients, physicians, nurses, and pharmacists.

Low Cost Improvements:
- Supplement verbal communication with written communication.
- Educate patients on the importance of understanding the medications they are taking and communicating that information to care providers. An effective measure might be the use of awareness slogans on UMHS websites, as well as the addition of statements concerning potential consequences of inaccurate patient medication information on appointment slips. Physicians should also work to educate patients about their medications, including specific drug information, other names for the drug, side effects,
and possible drug and dietary interactions. UMHS could also provide a standardized “UM Patient Card” to patients, which would contain a current medication list that would be updated by a UMHS physician. These suggestions aim to improve the medication reconciliation process from the source.

**High Cost Improvements:**

- Implement the Orders Management Project (OMP) to reduce (1) communication barriers between inpatient units and the pharmacy, (2) steps and waste in the ordering process, and (3) room for human error.
- Ensure no unit is electronically isolated from other units in the new system. To do this, consult information technology specialists to give isolated units integration to the common system.

**Ensure nurses are properly trained on the process of reconciling the MAR with physicians’ orders.**

**Low Cost Improvements:**

- Educate nurses on how to properly reconcile the MAR with orders. Hold training sessions where a demonstration is done. Create a standard document outlining the process to follow and distribute it to inpatient nurses. Ensure nurses understand the process to follow when a discrepancy exists between the MAR and orders.
- Recommend that MARs be reconciled at the end of each shift, in addition to nightly.
- Stress the importance on patient care of reconciling the MAR.
- Create a standard method for each unit to follow to check for new orders and get them to the pharmacy in a timely fashion so no delay will exist in administering the proper medications.
- Create a special place on the MAR for medications that are administered weekly and an indication that the medication is not to be given everyday.
- Determine the frequency and the root cause of the discrepancies between the MAR and physician orders.

**REFERENCES**


