Introduction

Mission

The Pharmacy Department’s mission is to provide evidence-based, cost-effective and safe drug therapy, with the purpose of attaining optimal patient care outcomes. To achieve this, maximization of technology and the emphasis on education, training, and development of pharmacy staff are emphasized.

About the Pharmacy Department

Mount Sinai Hospital’s pharmacy department has greatly expanded its level of clinical services and scope of practice over the past 8 years. The previous pharmacy model focused on the distribution of medications and the pharmacists worked mainly within the four walls of the pharmacy. Today, pharmacists practice on patient floors where the focus is on direct patient care and providing evidence-based recommendations to doctors and other healthcare professionals. This change in MSH pharmacy practice was a multi-year process that required a high level of staff engagement and leadership.

The growth of pharmacy clinical services was accomplished through the acquisition of talented and residency-trained pharmacists. Pharmacy residencies require at least one year of intense pharmacy practice training that is considered professionally to be equivalent to 3 years of hospital practice experience. In 2007, the pharmacy department only had one residency-trained pharmacist. Today, there are over 30 residency-trained pharmacists on staff. In addition to residency training, pharmacists can obtain board certification in pharmacotherapy through BCPS examination which formally affirms a pharmacist’s strong fundamental understanding of drug therapy across dozens of diseases. The pharmacy department grew from having 0 to 17 BCPS-certified pharmacists.

With a talented and engaged pharmacy staff, our clinical staff pharmacists have expanded the level of pharmacy-provided clinical services to improve patient safety and outcomes. The clinical staff pharmacists are located on general medicine floors where they provide in-person pharmacy guidance to doctors, residents, nurses and other healthcare providers. They are also responsible for implementing pharmacy-driven initiatives designed to provide evidence-based medication management strategies to patients. Some of these roles include anticoagulation management, antimicrobial stewardship, disease state management, bedside discharge counseling, and therapeutic drug monitoring.

The scope of pharmacy practice has grown into high-risk areas where a medication specialist is needed. At MSH, the first clinical pharmacist acquired in 2009 specialized in critical care medicine. Since then, the role of pharmacy specialists has expanded to other high-risk areas such as emergency medicine, surgical intensive care unit, oncology, infectious diseases, and pediatrics. All hired clinical specialists have undergone a second year of residency to become experts in the evidence-based practices of their respective specialty. Clinical specialists are invaluable to the hospital not only for their...
depth of knowledge but also for their ability to develop hospital-wide guidelines, order-sets, and procedures in their specialized areas.

Pharmacy is at the forefront of medication safety. The pharmacy department has been able to acquire new technologies that improve workflow efficiencies and automate processes to prevent errors from reaching the patient. Some recent technology implementation include two-way wireless smart pumps, MedMined™ clinical surveillance application, DoseEdge™ IV workflow manager, Baxter Exactamix™ TPN compounder, and McKesson™ automation, including 30 Acudose™ machines, 2 MedCarousels™, 1 PACMed™, and 3 Narcotic Towers. Together, these technologies improve the accurate dispensing and safe administration of many medication formulations. Automation has also allowed for pharmacists to focus on expanding clinical services to the patients on the floors.

The development of MSH’s pharmacy practice residency program symbolized the growth, success, and stability of the department. A strong residency program requires two key ingredients: reliable operations and a variety of clinical learning experiences. These pieces are needed to create a learning environment where a resident will be able to receive a well-rounded experience. It’s no surprise that many of MSH’s resident graduates have decided to stay within SHS. Since the start of the residency program in 2010, six of eight graduates have been hired within SHS. They required minimal training and instantly increased the level of pharmacy clinical services. The residency program has also been invaluable in developing future department leaders. Both MSH and HCH pharmacy operations managers were past MSH residents.

Mount Sinai Hospital has fostered the development of a highly-trained pharmacy staff that goes above and beyond the traditional inpatient pharmacy model. Mount Sinai’s pharmacy department provides for patients in a wide variety of services that differentiate it from its peers and bring incredible value to the hospital. The pharmacy department has embraced the vision and mission of Sinai Health System and will continue to bring a high level of service to its patients.
1. **Defining and measuring pharmacy productivity to allow operational adjustments to further impact positive outcomes and increase direct patient care**
   a. Identifying patient care priorities at Mount Sinai Hospital and Schwab Rehabilitation Hospital that can be advanced by redeployment of pharmacists
   b. Focusing on data-mining for the purposes of performance improvement and to assist in operational and clinical decision-making
   c. Developing expertise in data analytics to ensure the best use of data to improve individual patient and population-based care
   d. Creating cascading goals dashboard in alignment with Sinai Health System Key Performance Indicators (KPIs) to assess progress

2. **Creating an inpatient medication therapy management program to expand transitions of care program services within Mount Sinai Hospital and Schwab Rehabilitation Hospital**
   a. Establishing close alliances with organizational leaders by contributing to initiatives in population health, risk contracting, and strategic partnerships

3. **Limiting expected growth of drug expenditures through multiple departmental initiatives**
   a. Performing medication utilization evaluations of high cost drugs identified through the 80/20 report along with diligent and often daily support from clinical pharmacists guiding day-to-day medication management through appropriate order sets and guidelines
   b. Optimizing inventory management, reducing waste, and eliminating non-urgent low volume usage products from the drug formulary

4. **Maximizing revenue opportunities through our 340B drug pricing program, specialty pharmacy program, and on-site outpatient retail pharmacy**
   a. Meeting regulatory compliances surrounding the 340B program with appropriate oversight and program compliance responsibilities

5. **Continuing to professionally engage our staff**
   a. Leveraging and increasing the utility of pharmacists, APPE students and pharmacy technicians to provide more direct patient care through patient education, medication histories and medication reconciliation
   b. Establishing a sound process for identifying the competency requirements of pharmacists and technicians for specific responsibilities and assessing every staff member for compliance with competency requirements
   c. Encouraging continuous professional development of each pharmacist and technician related to competency requirements surrounding increased direct patient care and medication safety initiatives
Clinical Interventions...Daily interventions pharmacists make to improve patients’ medication management

Hospital-Wide Order Set and Guidelines Development...Order sets, guidelines, medication use evaluations, and formulary reviews

Warfarin Management...MSH’s pharmacist-driven warfarin management is one of the best performing programs in the nation

Vancomycin Dosing and Monitoring...Pharmacy-driven vancomycin dosing led to a positive impact on patient care with an increase of initial therapeutic goals being met

Diabetes Management...The role of an ambulatory care pharmacist has resulted in significant improvement in the care of the diabetic patient population

Bedside Discharge Prescription Concierge Services...Discharge technicians play a vital role in transitions of care by bringing patients their outpatient prescriptions before discharge to improve medication access

Medication Reconciliation...A resident pilot program investigates the benefits of having a pharmacist-driven medication reconciliation and transitions of care process.

Inhaler Teaching Technique...A student-driven initiative under supervision of a clinical pharmacist to ensure patients understand how to use their inhaler prior to discharge
Value-Added Services

Antimicrobial Stewardship..............................................................................................................Page 14
Decentralized pharmacists ensure proper antibiotics use to limit unintended side effects such as clostridium difficile infection

Medication Assistance Program.........................................................................................................Page 19
MAP technician finds opportunities to replace high-cost medications through manufacturer programs for self-pay patients

Inpatient Pharmacy Distribution Services..........................................................................................Page 20
Pharmacy buyer provides medications to Sinai Medical Group clinics to reduce exposure to outsourcing services through wholesaler

Oncology Pharmacy Services..............................................................................................................Page 21
Clinical pharmacy oncology specialist works with physicians to provide excellent chemotherapeutic treatment while limiting unnecessary use of high-cost drugs

Insulin Dispensing Procedure..............................................................................................................Page 22
A medication safety initiative that resulted in improved patient safety and significant savings

Palivizumab Monitoring Program.......................................................................................................Page 23
Pediatric pharmacist-driven initiative to improve prescribing habits of palivizumab to eligible patients under American Academy of Pediatrics guidelines

Summary Table: Value Added Services

<table>
<thead>
<tr>
<th>Services</th>
<th>Annualized Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimicrobial Stewardship</td>
<td>$309,000 - $535,000</td>
</tr>
<tr>
<td>Outpatient Pharmacy Distribution Services</td>
<td>$250,000</td>
</tr>
<tr>
<td>Medication Assistance Program</td>
<td>$150,000</td>
</tr>
<tr>
<td>Palivizumab (Synagis®) Guideline Intervention</td>
<td>$100,000</td>
</tr>
<tr>
<td>Insulin Dispensing Procedure</td>
<td>$46,000</td>
</tr>
<tr>
<td>Chemotherapy Dose Rounding</td>
<td>$24,000</td>
</tr>
<tr>
<td>Total</td>
<td>$1,565,000</td>
</tr>
</tbody>
</table>
Clinical Services
Clinical Interventions

Background

- Clinical interventions (CI) represent the daily clinical activities a pharmacist performs on individual patients.
- In practice, pharmacists use interventions to document ongoing issues with patients that require follow-up.
- Pharmacists provide a wide range of interventions that range in different areas such as medication therapy management, direct patient care, reducing medication errors, or improving workflow.

Clinical Interventions in 2014

- **Direct Patient Care**
  - Patient Education
    - Warfarin Specific Education
    - Disease Management Interventions (i.e. Diabetes and Heart Failure)
    - Patient Education and Counseling
  - Medication History and Medication Reconciliation
    - Obtained by pharmacy technician
    - Obtained by pharmacist
  - HCAHPS Improvement Pilot Pharmacist Intervention (HIPPI)
  - Pain Rounds
- **Optimization of Medication Therapy**
  - Antimicrobial optimization
  - Medication dose optimization
  - Medication Regimen optimization
- **Monitoring of Medication Therapy**
  - Prophylactic anticoagulation monitoring
  - Therapeutic drug monitoring
  - Therapeutic anticoagulation monitoring
  - Vancomycin therapeutic drug monitoring
- **Recommendations to Prescribers**
  - Renal dosing recommendations
  - TPN recommendations
- **Streamlining and Workflow**
  - Chemotherapy waste tracking
  - Other (i.e. non-formulary alternatives, cost saving initiatives)
- **Clarification of Physician Orders**
- **Allergy Clarification**

20,381 total documented interventions in 2014

**Considerations**

Due to the fast paced nature of the hospital workflow, clinical interventions are often under reported. However, the focus of pharmacy clinical interventions should be on quality rather than quantity. MSH pharmacists have expanded from traditional pharmacy practice (i.e. allergy clarification, monitoring of medication therapy, etc.) to direct patient care activities (i.e. pain rounds, HCAHPS improvement initiatives, disease management, etc.). Direct patient care activities put the pharmacist at the front lines of patient care and give the opportunity for pharmacists to improve clinical outcomes and increase patient satisfaction.
### Hospital-Wide Order Set and Guideline Development

#### Background
Pharmacists provide leadership in the development of standardized hospital-wide protocols and procedures to ensure each patient is treated with the most up to date evidence-based recommendations.

- **Order sets** - a standardized list of orders for a specific diagnosis.
  - Carefully developed through extensive search of medical literature for evidence-based standards
- **Guidelines** - recommendations for clinicians about the care of patients with specific conditions.
  - Based upon the best available research evidence and practice experience
- **Formulary review** - addition or deletion of medication from the drug formulary requires pharmacy-driven research of clinical outcomes and cost-benefit analysis
  - Interchange – a policy that allows for one medication to be automatically switched to another (i.e. multiple medications in a drug class) for the purposes of decreasing drug spend and preserve shelf space
- **Medication Use Evaluation** - performance improvement method that focuses on evaluating and improving medication-use processes with the goal of optimal patient outcomes

#### 2013

<table>
<thead>
<tr>
<th>Order Sets</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Severe HTN in the Third Trimester of Pregnancy</td>
<td>1. Severe HTN in the third trimester of pregnancy</td>
</tr>
<tr>
<td>2. Critical care cardiology admission</td>
<td>2. Alcohol withdrawal</td>
</tr>
<tr>
<td>5. Chest pain – Code Heart (STEMI)</td>
<td>5. Insulin infusion protocol for CABG and traumatic brain injury</td>
</tr>
<tr>
<td>7. Alcohol withdrawal</td>
<td>7. Albumin &amp; tetrastarch guidelines</td>
</tr>
<tr>
<td>8. Seizures &amp; Phenytoin</td>
<td>8. Rasburicase guidelines</td>
</tr>
<tr>
<td>9. Heparin protocol (update)</td>
<td>9. Heparin &amp; enoxaparin reversal</td>
</tr>
<tr>
<td>11. Specialty</td>
<td></td>
</tr>
<tr>
<td>12. Sepsis order set</td>
<td></td>
</tr>
<tr>
<td>13. SRH TPN order forms</td>
<td></td>
</tr>
<tr>
<td>14. Critical care HF admission</td>
<td></td>
</tr>
<tr>
<td>15. tPA eligibility &amp; initial orders</td>
<td></td>
</tr>
<tr>
<td>16. tPA floor admission</td>
<td></td>
</tr>
<tr>
<td>17. Ischemic stroke/TIA floor admission (patient not receiving tPA)</td>
<td></td>
</tr>
<tr>
<td>18. Postpartum order for vaginal deliveries</td>
<td></td>
</tr>
<tr>
<td>19. Postoperative C-section orders</td>
<td></td>
</tr>
<tr>
<td>20. Non-ICU Insulin order set</td>
<td></td>
</tr>
<tr>
<td>21. COPD admission orders</td>
<td></td>
</tr>
<tr>
<td>22. NICU TPN</td>
<td></td>
</tr>
<tr>
<td>23. Pavilizumab – pediatrics</td>
<td></td>
</tr>
<tr>
<td>24. Hyperkalemia</td>
<td></td>
</tr>
<tr>
<td>25. Contrast allergy pre-medication</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Formulary Review</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additions</strong></td>
</tr>
<tr>
<td>1. Epzicom (abacavir/lamivudine)</td>
</tr>
<tr>
<td>2. Quinupristin/dalfopristin</td>
</tr>
<tr>
<td>3. Ciprofloxacin (oral)</td>
</tr>
<tr>
<td>4. Valacyclovir (oral)</td>
</tr>
<tr>
<td>5. Tranexam acid</td>
</tr>
<tr>
<td>6. Isentress (raltegravir)</td>
</tr>
<tr>
<td><strong>Removals</strong></td>
</tr>
<tr>
<td>1. Oxazepam</td>
</tr>
<tr>
<td>2. Glyburide micronase</td>
</tr>
<tr>
<td>3. Calcium gluconate (oral)</td>
</tr>
<tr>
<td>4. Magnesium gluconate (oral)</td>
</tr>
<tr>
<td><strong>Interchanges</strong></td>
</tr>
<tr>
<td>1. ACE inhibitor and ARBs class review(update)</td>
</tr>
<tr>
<td>2. Inhaled corticosteroids class review(update)</td>
</tr>
<tr>
<td>3. Bacitracin to Erythromycin ointment</td>
</tr>
</tbody>
</table>
Hospital-Wide Interventions

2014

Order sets
1. Sexual assault – ED
2. Hyperglycemic hyperosmolar syndrome – MICU
3. Code sepsis order set
4. Neuromuscular blockade
5. Adult procedural sedation
6. Pediatric procedural sedation
7. Heparin for vascular procedure patients
8. Post-exposure prophylaxis
9. Sepsis order set
10. Diabetic ketoacidosis
11. VTE prophylaxis
12. Pediatric pneumonia – ED
13. Newborn HIV
14. Analgesia & sedation – MICU
15. Pediatric admission

Medication Use Evaluations
1. Vancomycin in HD
2. Simvastatin
3. Medication use in COPD patients

Formulary Review
Additions
1. Paliperidone (oral)

Removals
1. Ibutilide
2. Methyldopa IV
3. Nesiritide
4. Inamrinone
5. Atracurium
6. Urokinase
7. Miscellaneous Ophthalmic Products

Interchanges
1. Statin class review
2. Combivent® to Duoneb®

Guidelines
1. Sexual assault
2. Sexually transmitted diseases
3. Post-exposure prophylaxis
4. Sodium Bicarbonate – adult
5. NICU Surfactant
6. Neuromuscular blockade
7. Procedural sedation
8. Anti-Xa level ordering
9. Analgesia & sedation – MICU (review)
10. Aminoglycosides (update)

Considerations
- The development of each hospital-wide intervention takes months of preparation and is then presented to P&T for approval
  - Policies and procedures involving medications or pharmacy services are also reviewed and approved at P&T
- Each hospital-wide intervention requires coordination and input from pharmacy management, nursing, physicians, and other key stakeholders
Warfarin Management

Background
Anticoagulants such as warfarin and unfractionated heparin are among the highest risk and most commonly used medications.

- Lead to serious consequences if mismanaged (i.e. bleeding or clots)
- MSH pharmacists verify and manage every warfarin order
- Medication safety officer, who is a pharmacist, oversees safe medication practice of warfarin

Adverse Drug Reactions
Bleeding events associated with anticoagulant therapy lead to increased length of stay and increased cost to the health system.

- Bleeding complication nearly double the average cost of stay from $24,000 to $41,000
- Average treatment cost of a major bleeding event costs $12,900

Pharmacist-led Warfarin Management
MSH pharmacists manage every active warfarin, including Schwab patients

- Verify every warfarin order and evaluate each patient for risk of bleeding complications
- Provide consults and INR evaluations that guide physicians to appropriate warfarin dosing
- Identify clinically significant drug-drug interactions
- Write clinical follow-up notes for each warfarin patient as a handoff to the next pharmacist
- MedMined® surveillance used to identify real-time inappropriate INR levels for immediate follow-up
- Respond to abnormal INR lab results from ADR hotline
- Monthly warfarin reports for significant INR levels are investigated case by case
- Educate patients on the proper use of warfarin to prevent adverse events

National Comparison

Adverse Warfarin Alerts/100 Warfarin Days of Therapy 2014

- MSH provides superior warfarin service as compared to 181 hospitals nationally
- MSH has never been above the national range
- Reached top performance quartile for management of warfarin therapy

Data obtained from Medmined® surveillance services
Vancomycin Dosing and Monitoring

Background
Mount Sinai Hospital implemented guidelines for the dosing and monitoring of Vancomycin in the spring of 2011 to improve clinical outcomes of complicated infections. The implemented changes reflect the recommendations provided by the joint consensus statement authored by the Infectious Diseases Society of America (IDSA), the American Society of Health-System Pharmacists (ASHP), and the Society of Infectious Diseases Pharmacists (SIDP) 2009 guidelines.

- Serum drug level monitoring is done for medications with a narrow therapeutic index and established ranges
- Obtaining therapeutic serum levels for vancomycin can help improve clinical outcomes and reduce medication errors and patient costs
- Highlights of the IDSA/ASHP/SIDP 2009 consensus statement for Vancomycin include:
  - Adequate initial doses for the attainment of serum concentrations of at least 10 mcg/mL
  - Trough levels of 15-20 mcg/mL

Services Provided
- Medication management by pharmacists
  - Initial mg/kg dosing provided
  - Serum trough levels ordered and monitored by the pharmacist
  - Dosing adjustments made to achieve desired trough levels
  - Documentation in patient chart and electronic health record via progress notes

Study Outcomes
Retrospective review completed to compare vancomycin dosing and serum level monitoring in the adult SHS population pre- and post-implementation of guidelines

Guideline implementations resulted in a 35.2% increase in the number of patients with initial serum concentrations at therapeutic levels
  - 29 patients with therapeutic levels post-implementation vs. 13 pre-implementation
Guideline implementations also resulted in a decrease of patients with vancomycin serum concentrations at subtherapeutic levels

- Despite more aggressive dosing, there was no significant sustained increase in serum creatinine
- Results also included:
  - Overall fewer drug levels ordered
  - Fewer canceled levels
  - Fewer unnecessary levels drawn and resulted
  - Decrease of missed ‘recommended’ level draws, i.e. no long periods of time without monitoring drug levels or serum creatinine

Considerations

- Guideline implementations for vancomycin dosing and monitoring by pharmacy, had a positive impact on patient care
  - Attainment of therapeutic levels
    - Greater percent of initial therapeutic levels
    - Decrease in percent of levels in the subtherapeutic range
  - Less needle-sticks/draws for patients
  - Decrease costs for inpatient visit due to decreased lab draws
Ambulatory Care - Diabetes Management

Background
Sinai Health System implemented a disease management outpatient program in late 2012 to improve continuity of care for diabetic patients with A1c > 9%. Community surveillance revealed diabetes prevalence of 29.1%. A 0.5 FTE ambulatory care pharmacist position was created to improve care and become an integral member of the diabetes management team.

- Hemoglobin A1c testing has become an important process measure that can drive reimbursement
- Every 1% increase in A1c leads to 18% increase in risk of cardiovascular disease (CVD)
- Improvement in A1c control (≤9%) associated with annual average of 2% decrease in hospitalization days
- Hazard ratio for mortality associated with poor A1c control (defined as HgbA1C > 9%) 1.78

Services Provided
- Medication management
  - Dose titrations for improving efficacy and decreasing adverse events (hypoglycemia)
  - Optimization of affordable medications
  - Drug interaction management
- Ensuring components of Comprehensive Diabetes Evaluation are followed
  - A1c results within past 2-3 months
  - Annual fasting lipid profile, including LDL-C
  - Annual urine microalbumin screen
  - Annual comprehensive foot examination including pulse palpation and monofilament exam
  - Annual retinal or dilated eye exam
- Customized diabetes education
- Facilitating access between patients, medical visits and medications
- Same-day appointments as physician visits

Study Outcomes
- Only the treatment group met with members of the diabetes disease management team
- Control group was restricted to patients who only met with the physician

- In one year, patients with additional diabetes management had a 15% decrease in baseline HbA1c vs 5.6% decrease in patients with only physician visits
- Patients in the diabetes management group had higher index of co-morbidities vs. the control group (5.4 vs. 2.8)
Ambulatory Care - Diabetes Management

**Percentage of completion of comprehensive diabetes evaluation by group**

<table>
<thead>
<tr>
<th>Service</th>
<th>MD-only</th>
<th>Diabetes Management w/ PharmD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophthalmology exam</td>
<td>28%</td>
<td>52%</td>
</tr>
<tr>
<td>Comprehensive foot exam</td>
<td>52%</td>
<td>81%</td>
</tr>
<tr>
<td>Microalbumin screen</td>
<td>73%</td>
<td>86%</td>
</tr>
<tr>
<td>A1c within 3-6 months</td>
<td>63%</td>
<td>95%</td>
</tr>
<tr>
<td>Annual Lipid Panel</td>
<td>63%</td>
<td>81%</td>
</tr>
</tbody>
</table>

- The diabetes management group outperformed the control group on all comprehensive diabetes evaluation measures.
- Patients in the treatment group had an average of 4.2 additional visits with the pharmacist:
  - Compared to an average of 3 visits with dietitian, 2 visits with social worker, and 2.2 visits with nurse
  - Follow-up telephone calls - 66 were performed by the pharmacist out of 189

**Considerations**

- Ambulatory care pharmacist had a positive effect on patient care:
  - Greater improvement in HbA1c levels (10% more than doctor visits alone) – decreases risk of cardiovascular disease
  - Patients were more likely to follow-up with other exams
  - Demonstrated great leadership and production - highest number of average visits and handling a third of all follow-up phone calls
- Patients followed by the pharmacist were often sicker with more comorbidities
- Improvement in HbA1c has shown to decrease risk of cardiovascular disease, hospitalization days, and mortality
Background

- Medication therapy must be continued as soon as possible after discharge
- Interruptions in medication therapy during transitions of care can negatively impact patient outcomes and increase hospital readmissions
  - Failure or delays in filling prescriptions at the time of hospital discharge
  - Patients may not be aware of purpose of medication or the necessity of medication adherence
- Patients are more likely to continue treatment after discharge if they have medications in hand

Concierge Service

- Fill prescriptions and hand-deliver to patients at bedside before they are discharged
  - Improved adherence
  - Decreased barrier for receiving medication
- Pharmacist-led discharge medication counseling
  - Explain to patients why they are taking certain medications
  - Educate patients on how to take their medications
  - Inform patients how to manage their medications
  - Discuss potential medication adverse events and self-monitoring parameters
- Answer any questions they may have about their medications

Goals

- Reduce readmissions
- Decrease ED visits due to a lack of medication
- Improve medication adherence & patient education
- Improve patient satisfaction

Considerations

- Patients have positively responded to bedside discharge concierge service
  - Majority of patients consulted choose to partake in discharge program
- On average, 50 patients monthly utilize service
  - Each patient averages 3-6 medications filled per visit
- December 2014 to January 2015 saw a 100+ increase of prescriptions filled due to a pharmacy resident project to see the impact of having a transitions of care pharmacist
Medication Reconciliation
Resident’s Project

Background
- Poor communication of medical information at transitions of care (TOC) is responsible for ~50% medication discrepancies and 20% of adverse drug events
- Medication reconciliation (MR) across the continuum is a national patient safety goal cited by The Joint Commission
- Hospital discharge is a critical transition due to limited patient monitoring
- Pharmacist assisted medication reconciliation at discharge has been demonstrated to reduce preventable adverse drug events up to 40% prior to discharge

Resident-led Pilot
From December 8, 2014 to February 5, 2015, a pharmacy resident-led pilot program was developed to identify safety benefits of having a pharmacist incorporated in the medication reconciliation and transitions of care process

Intervention Process

Medication history at admission
- Acquire and document complete accurate medication history and reconciliation at admission

Inpatient counseling
- Provide disease state counseling
- Medication education
- Bedside discharge services

Discharge medication reconciliation
- Review medications before a patient is sent home
- Contact physician to correct any errors
- Deliver medications at bedside and counsel

Results
- 56 complex patients were included in the study (who had either COPD, CHF, diabetes, coronary artery disease, cerebrovascular accident, or thromboembolism)
- 2959 routine medications were reviewed
  - Average 11.2 medications per patient
  - Average 2.1 medications were added from admission to discharge
  - Average 1.9 medication discrepancies per patient (107 total discrepancies found)

<table>
<thead>
<tr>
<th>Type</th>
<th>Percent (%)</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Omission</td>
<td>57</td>
<td>Beta blocker for CHF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rescue inhaler for COPD</td>
</tr>
<tr>
<td>Wrong Dose</td>
<td>21</td>
<td>Insulin for DM</td>
</tr>
<tr>
<td>Duplication</td>
<td>11</td>
<td>2 statins for CAD</td>
</tr>
<tr>
<td>No Indication</td>
<td>8</td>
<td>PPI</td>
</tr>
<tr>
<td>Drug/Disease</td>
<td>3</td>
<td>Ibuprofen in CHF</td>
</tr>
</tbody>
</table>
35 prevented errors could have caused moderate to critical patient harm
Prevention of approximately 1 potential adverse drug event per patient

18 of the 56 patients were “frequent flyers” and were readmitted in the past within 30 days
After receiving pharmacist-led intervention, only 11 patients were readmitted (39% reduction)
Since this was an observational study, it cannot be proven that pharmacists was the factor in 30 day readmission

**Considerations**
- Medication errors resulting from inaccurate medication histories are abundant from admission through discharge
- Pharmacists provide positive value for inpatients to prevent medication reconciliation errors that can cause harm
- Reducing harm and education could result in reducing 30 day readmission
Inhaler Teaching Technique
COPD Disease Management

Background
Sinai Health System’s inpatient education program incorporated inhaler teaching in January 2014 to ensure COPD patients who were prescribed inhalers were given the necessary teaching required to use the inhalers appropriately and effectively.

- Management of chronic airway disease has been said to be “10% medication, 90% education”
- Patients hospitalized for COPD exacerbations have many modifiable risk factors, including poor inhaler technique
- Placebo inhaler teaching is facilitated by advanced pharmacy practice experiential (APPE) students under clinical pharmacist oversight
- Per expert guidelines, all patients receiving new prescriptions for inhalers should have initial training
  - Reassessments should be given regularly to ensure retention of education

Teaching Method

![Figure 1: Initial Session and Follow-up Session](image)

Study Outcome

- 276 patients assessed initially from January 15, 2014 to May 15, 2014
- 86 patients completed follow-up assessments

![Figure 2: Assessment scores at baseline and follow-up](image)

Considerations

- Failure to educate the hospitalized patient can result in inappropriate use after discharge, potentially resulting in re-admission
  - Readmission rates for COPD decreased from the 2013 baseline average of 21.5% to 11.0% in the first 6 months of 2014
- Significant improvements were seen in patients’ inhaler technique
Value-Added Services
Antimicrobial Stewardship

Background
Antimicrobial stewardship programs (ASPs) improve patient safety, quality of care, and significantly reduce the rate of hospital-acquired of *Clostridium difficile* infection (CDI).
- ASPs are endorsed by the CDC, IDSA, ASHP, and the Joint Commission

Pharmacy-Led Antimicrobial Stewardship Program
- Coordinated and supervised by ID specialized pharmacist and implemented by decentralized pharmacists
- Pharmacy interventions
  - Recommend cost-saving alternative antimicrobials when high-cost antibiotics are ordered
    - Limiting use of IV access by recommending IV to PO conversion of antimicrobials when appropriate
  - Re-evaluation of antimicrobials within 24-48 hours of antimicrobial initiation
    - Ensure appropriate microbial coverage based on indication
    - Evaluate microbiology, imaging, kidney function, lab values and vital signs and assessing the appropriateness of continuing antimicrobials
    - De-escalation of antimicrobials as appropriate based on culture results
  - Antimicrobial optimization
    - Clinical follow-up notes to address antimicrobial adjustments based on drug-levels and site of infection
    - Ensure antimicrobials are infused over appropriate time intervals based on pharmacokinetic principles
    - Monitor duration of antimicrobial use and ensure consistency with IDSA guidelines
  - Identify and prevent clinically significant drug-drug interactions with antimicrobials
  - Educate medical personnel on appropriate antibiotic regimens and monitoring parameters
- Utilizing MedMined® technology to aid in stewardship
  - Triggers created by the medication safety and ID pharmacist
    - De-escalation of therapy
    - IV to PO conversion
    - Bug-drug mismatch

Drug Savings from Pharmacy-Led Antimicrobial Stewardship
MSH overall antimicrobial use from 2012 – 2014 is significantly lower than teaching and non-teaching hospitals on a national and Midwest regional level.
Antimicrobial Stewardship

Piperacillin-tazobactam

- MSH has a significantly lower usage of piperacillin-tazobactam, which are considered broader in spectrum of therapy, among national teaching and non-teaching hospitals
  - Results in **$66,000 in savings** when compared to the usage at a national level
  - Piperacillin-tazobactam maintains a remarkable 92% susceptibility at to *Pseudomonas aeruginosa*, a potentially life-threatening hospital-acquired organism known for antibiotic resistance

![Piperacillin/Tazobactam National Comparison Graph](chart)

**High-cost, gram-positive antimicrobials**

- MSH use of high-cost gram-positive agents, such as daptomycin and linezolid, are significant lower than other US institutions
  - Daptomycin cost savings = **$78,000**
  - Linezolid cost savings = **$210,000**

![Daptomycin National Comparison Graph](chart)

![Linezolid National Comparison Graph](chart)
Antimicrobial Stewardship

- Vancomycin is primarily used for empiric treatment of suspected gram-positive infections
- When compared to other institutions, MSH uses vancomycin less often than other teaching hospitals

Other antibiotic drug class comparisons

MSH’s antimicrobial stewardship program has produced great results in antibiotic utilization. Across multiple antibiotic drug classes, MSH is treating patients more efficiently with less treatment days compared to the rest of the nation.
Clinical Outcomes - Clostridium difficile Infection (CDI) Rates

- CDI is a serious adverse effect caused by improper antimicrobial usage that increases patient length of stay and healthcare costs
- MSH’s ASP outperforms both teaching and non-teaching hospitals nationally in terms of low antibiotic use
  - Appropriate antibiotic duration of therapy treatment results in lower CDI rates

- Mount Sinai stool NIMs (surrogate for hospital-onset C diff) as % of all admissions is 72.4% lower than rates at teaching hospitals (0.17% of admissions at Mount Sinai vs. 0.53% of admissions nationally).
  - Each additional stool NIM costs Mount Sinai an additional $12,318 and 9.3 days length of stay
  - Current additional cost of CDI at MSH is $369,530 at MSH Stool Rate of 0.17%.
  - If we were at the Academic Hospital Average (0.52%) the cost would be $1,130,326.
  - This represents a cost avoidance of $760,797 at MSH due to robust Antimicrobial Stewardship.

- The estimated true cost prevented at MSH is $144,000
  - Basic Sinai expenses - facility costs ($250 per day) and drug costs ($250 per day)

- Proton pump inhibitor (PPI) usage is another risk factor for CDI
- MSH has consistently been a top performer among teaching and non-teaching facilities in PPI use
Antimicrobial Stewardship

Considerations

- Antibiotic stewardship is implemented by all pharmacists in coordination with infectious diseases specialist
- Appropriate antibiotic therapy provides great outcomes while saving money on the drug budget
- For 3 antibiotics, antibiotic stewardship amounts to an annualized $165,000 in drug spend savings
- Clostridium difficile clinical outcomes brings an estimated annual savings of $144,000 to $370,000

Estimated annual savings from antimicrobial stewardship program is $309,000 to $535,000

- Since only 3 antibiotics were analyzed, true annual savings is expected to be much higher
- MSH has shown superior antimicrobial stewardship compared to other hospitals around the nation
Medication Assistance Program

Background
- Medication assistance or drug replacement program is designed to assist indigent populations in filling their prescriptions
  - Medication assistance program – manufacturer patient assistance programs and other cost-savings programs designed to ease the burden of affordable medication for patients
  - Drug replacement program – manufacturer programs that allow for replacement of medications used on indigent patients
    - Directly decreases overall pharmacy drug costs

Medication Assistance Process

**Referral**
- MD enters referral for medication assistance program

**Assistance**
- Social worker and pharmacy technician help fill out manufacturer assistance forms for patient
- Explore Medicaid enrollment, 30 day trials

**Enrollment**
- Patient able to continue medication regimen
- Avoid large financial burdens
- Improved adherence

Drug Recovery
- From September to December 2014, $53,000 of drug replacement was recaptured
- Annual projection = $150,000

Considerations
- Investigating stent recovery for indigent patients and high dollar inpatient drug recovery
- Current position also includes pharmacy operation and leadership responsibilities
  - Assists with maintaining pharmacy automation
  - Trains new employees on how to use pharmacy automation
  - Assists pharmacists working in clinics with medication assistance process
  - Bills anticoagulation clinic patient visits
  - Assures compliance with the drug recall policy and utilizes the Drug Recall software for completion and documentation of tasks
  - Ensures that all pharmacy areas at Schwab Rehabilitation Hospital that contain drug inventory will be inspected and maintained on a monthly basis
**Background**

Mount Sinai Hospital’s (MSH) inpatient pharmacy department has been providing Sinai Medical Group with outpatient pharmaceutical distribution for many years.

- Increase in number of outpatient clinics in the past couple of years
- 18 off-site locations which includes 21 clinics and 51 practices
- Also service 3 on-site clinics and 9 practices located at Mount Sinai Hospital

The pharmacy buyer’s primary responsibility is to service the inpatient medication purchase needs of Mount Sinai Hospital. Other responsibilities currently include:

- Sinai Medical Group pharmaceutical distribution services
- Assist in navigating drug shortages
- Ordering of supplies and large intravenous volume products
- Reconciling invoices with accounts purchasing
- Assist in 340B compliance

**Third-Party Service Comparison**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Outsource</th>
<th>Buyer</th>
<th>Technician Staff Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third Party Vendor</td>
<td>$283,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient Pharmacy Services</td>
<td>$24,882</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Does not include setup fee - $150 per clinic; additional cost of $2,700

**Considerations**

The pharmacy department has been able to absorb outpatient pharmacy distribution services through a number of workflow adjustments in the technician staff.

- Pharmacy buyer is primarily responsible for the outpatient clinics
- Some buyer responsibilities were shifted from to other technician staff to support new role

**Over $200,000 saved in costs while maintaining a high level of customer service to our clinics**
Oncology Pharmacy Services

Background
- From January 2014 to December 2014, the outpatient chemotherapy center has seen a 20% growth in the number of patients treated and the number of chemotherapy preparations made.
- Chemotherapy medications are some of the most costly and high-risk medications in the market.
- The role of the oncology clinical specialist in medication management includes appropriate medication selection, procurement, storage and handling, preparation and administering, prescribing, dosing, transcribing, monitoring and education of patients.

Roles and Responsibilities
Pharmacist Led Chemotherapy Services have impacted patient care and outpatient oncology services tremendously. In the last year, the oncology pharmacist drug-specific interventions include:
- Chemotherapy dose rounding
- First dose chemotherapy patient counseling for all patients
- Pharmacist order writing
- Chemotherapy preparation
- Guideline development
- Policy & procedures implementation

Chemotherapy Dose Rounding
- Service provided by the oncology clinical specialist
- The specialist will work with oncology physicians to provide the best care while appropriately rounding doses of chemotherapy on a case-by-case basis.
  - For example, if a dose uses a small fraction of a new vial of chemotherapy, the specialist will use her clinical judgment to determine if it is clinically necessary to use the additional vial.

From July 2014 to Feb 2015, the estimated drug savings from chemotherapy dose rounding is $17,975.93.
Estimated annualized drug savings on 340B drug spend = $24,000
**Insulin Dispensing Procedure**

**Background**
Insulin is one of the top five high-alert medications. The consequences of an error with a high risk medication are more devastating to patients.
- Insulin has a low therapeutic index and complex dosing.
- Safe insulin storage practices are necessary to reduce such errors from occurring.

**Safety Issue**
- Hospitals often store insulin vials on the nursing units (i.e. “floor stock”) for ease of use.
- Long-acting and intermediate-acting insulin are not emergently needed on the units.
- Storing all short and long-acting insulins on the units may create a situation for a nurse to choose the wrong insulin for administration.
- The MSH Medication Safety Committee agreed to remove long-acting and intermediate-acting insulin from the nursing units to improve patient safety.

**Intermediate and Long-Acting Insulin Dispensing Procedure**

**Financial Impact**

| A $46,000 cost savings was observed with intermediate- and long-acting insulins |

- Before the dispensing procedure was implemented, MSH was purchasing 28 vials of insulin glargine per month or 336 vials per year.
- In 2014, MSH purchased just 99 vials.
- At $151 per vial, MSH saw a cost savings of $36,000 in reduced waste from one insulin alone.
- $10,000 savings was observed with the intermediate and mixed insulins.

**Conclusion**
- Pharmacy reduced drug spend and improved patient safety.

**Assessments**
- New procedures absorbed into workflow with no additional FTE required.
- Decreased financial expenditure.
- No difference in med errors or adverse events but low reporting also present.
Background
- Respiratory syncytial virus (RSV) is a respiratory virus that will cause a pulmonary disease in up to 80% of children by the time they turn 2 years old
  - Children with certain conditions may need to be hospitalized, but the treatment is supportive
- Palivizumab (Synagis®) is used for prophylaxis of eligible infants from a severe viral infection caused by RSV
  - Prevents re-hospitalizations soon after discharge
- Its use is considered a standard of care but published guidelines from the American Academy of Pediatrics may change patient eligibility on a yearly basis
  - New research clarifying appropriate indication and outcome benefits
  - High cost ($1,200 per 50 mg)
- Prior to implementation of guideline usage, all neonates born less than 35 weeks of gestational age received a dose of palivizumab (majority of NICU patients)

Pharmacy-Led Palivizumab Monitoring Program
- Palivizumab monitoring program was implemented by the pediatric pharmacy specialist in coordination with neonatology
- On daily basis, a clinical pharmacist facilitates proper utilization of the guideline
- Pediatric pharmacist follows up with residents and attending physicians on potential discharges
- All eligible patients are tracked in a systematic way to ensure accuracy
- In order to reduce medication waste, eligible patients to be discharged in the same timeframe are also given a dose

Drug Savings from Pharmacy-Led Palivizumab Monitoring Program

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vial Size</td>
<td>Vial Cost</td>
<td># of Vials</td>
<td>Cost</td>
<td># of Vials</td>
</tr>
<tr>
<td>50 mg</td>
<td>$1,242.70</td>
<td>18</td>
<td>$22,368.60</td>
<td>7</td>
</tr>
<tr>
<td>100</td>
<td>$2,348.46</td>
<td>28</td>
<td>$65,756.88</td>
<td>27</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$88,125.48</td>
<td></td>
<td>$72,107.32</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Pre OS Spending</th>
<th>Post OS Spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Savings</td>
<td>$160,232.80</td>
<td>$61,186.66</td>
</tr>
<tr>
<td>+ $99,046.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Considerations
- Appropriate palivizumab therapy reduces admissions with RSV while saving money on the drug budget
- Since the implementation of the guideline by pharmacy in the fall of 2013, Mount Sinai Hospital has saved approximately $100,000