

UNIVERSITY OF MICHIGAN – DEPARTMENT OF PHARMACY SERVICES

ANNUAL REPORT FY2007

WELCOME FROM THE DEPARTMENT OF PHARMACY SERVICES



James G. Stevenson, Pharm.D., FASHP
Director of Pharmacy Services
Professor and Associate Dean for Clinical Sciences, College of Pharmacy

Welcome to the Department of Pharmacy Services Annual Report for Fiscal Year 2007. This was a year in which we continued to improve the quality of our services through implementation of some major projects and expansion of our clinical pharmacy services. Specifically, several major projects were implemented. Among these were the first activations of our computerized provider order entry system (CPOE) called UM-CareLink. The CPOE system was implemented in Womens Hospital and C.S. Mott Children's Hospital. UM-CareLink utilizes software from Eclipsys to allow computer order entry with an interface to the WORx Pharmacy Information System. In addition to this major initiative, 2007 was the opening of our new Cardiovascular Center with a combined OR/acute care pharmacy satellite, and completion of construction on our USP 797-compliant Class 10,000 clean room for the preparation of parenteral products. In addition to these departmental projects, we have worked with others in the University of Michigan Hospitals and Health Centers on plans for a replacement Children's and Women's Hospital (scheduled for opening in 2011 and for which ground has been broken). Multiple pharmacies are planned for the new Children's and Women's Hospital.

In April of this year we welcomed a new Associate Director. John Clark, PharmD, MS, joined the department after serving as Director of Pediatric Pharmacy at Johns Hopkins Hospital. John received his PharmD at the University of Toledo and he completed the MS/Administrative Residency at the University of Wisconsin. Nabil Khalidi, our previous Associate Director, assumed new responsibilities in the College of Pharmacy teaching some of the administrative courses and coordinating the College's International Program initiatives. Nabil continues to participate on the Department's Residency Advisory Committee.

During the previous year we have also had successful accreditation visits from the Centers for Medicare and Medicaid Services (CMS) as well as the American Society of Health-system Pharmacists (first time accreditation of PGY2 specialty residency programs in infectious diseases, hematology/oncology, pediatrics, critical care, and informatics).

Our department received recognition this past year from the University of Michigan for our work in developing systems and programs to efficiently manage our participation in the 340B drug purchasing program. This is a very complex program that requires virtual inventories and identification of eligible patients so that the appropriate products can be replaced at this preferential pricing level. A team led by Mike McGregory, Larry Ligeski, and Alice Schuman, were recognized with the University of Michigan's Business Intelligence Award for their work in this area.

We have continued to add outstanding staff and expand services to our constituents. This is largely due to the outstanding men and women in our department who provide services to our patients and their families. The following report highlights many of the activities and accomplishments in the various areas of our department during FY2007.

The department works to support the mission, vision, values and goals of the University of Michigan Health System and the UM College of Pharmacy. Our mission and goals are listed below:

Mission

The University of Michigan, Department of Pharmacy Services strives to attain the highest level of services in patient care, education, and research. It is our intention to utilize available resources in an efficient manner to achieve the following goals:

- *Patient Care:* To provide rational, progressive pharmacotherapy in a safe, efficient, and compassionate manner to enhance the quality of life for all patients we serve.
- *Research:* To provide a leadership role in the evolution of knowledge through the development and support of investigations to benefit the advancement of health care.
- *Education:* To provide current and innovative pharmaceutical information and instruction to health professionals, healthcare students and the general public.

Department of Pharmacy Services Specific Goals

To meet the University of Michigan Health Systems mission, vision, values, and goals.

To assure that pharmaceutical care is of the highest quality, meeting or exceeding community and national standards.

To identify pharmaceutical care issues, trends, and opportunities for improvement related to the systems that support that care.

To assure that pharmaceutical care, practice and professional performance are regularly, validly, and reliably evaluated.

To assure that procedures, methods, and systems are cost effective and demonstrate effective impact.

To conduct research and create new knowledge related to medications and pharmacy services in patients.

To participate in the education of pharmacy students, post-graduate pharmacists (residents and fellows), as well as other health professionals.

Collectively, by embodying these values and goals we help make the Michigan Difference <http://www.med.umich.edu/michigandifference/mdiff/index.htm>.

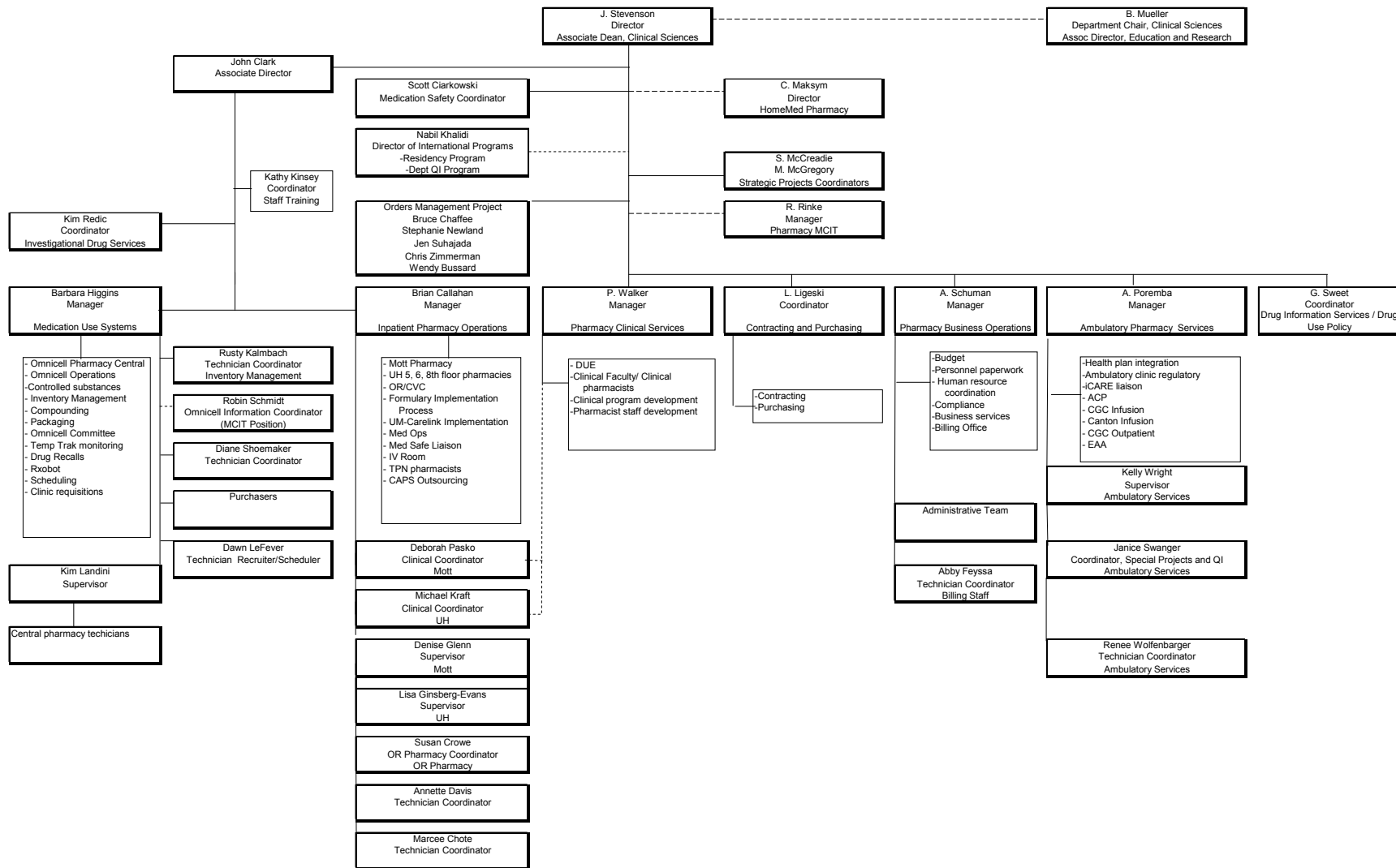
In order to achieve these goals we rely on excellence among our staff. In order to learn more about the department and joining our staff, please go to <http://www.med.umich.edu/careers/careers/pharmacy/index.html> for more information.

To see our current openings, please go to

<http://websvcs.itcs.umich.edu/jobnet/search.php?searchBox=pharmacy&searchwhat=current>.

An organizational chart of the department is displayed below:

Department of Pharmacy Services
Organizational Structure
Oct-07



INPATIENT SERVICES

The Inpatient Pharmacy Services, consistent with the values of the University of Michigan Hospitals and Health Centers, places a priority on patients and family, teamwork and never-ending improvement.

The Department is responsible for dispensing medications daily for an average inpatient population of 800 patients between the University and Mott Hospitals combined. Additional services are provided to support the Emergency Department and other outpatient and clinic settings. The Department consists of pharmacists as well as technical and support personnel, who work together to assure patients receive the highest quality pharmaceutical care possible.



Brian Callahan, Pharm.D.
Manager, Inpatient
Operations

There are currently 7 total inpatient pharmacy satellites:

University Hospital- 3 inpatient pharmacies and 1 OR pharmacy
Mott Children's Hospital- 1 inpatient pharmacy and 1 OR pharmacy
Cardiovascular Center – 1 pharmacy to service both inpatients and the OR

The Inpatient Pharmacy performs a wide range of duties 24 hours per day, 7 days per week. These include but are not limited to: prescription order entry, IV dosage and filling, chemotherapy admixtures, sterile lab and bulk drug compounding and packaging, filling of unit based medication cabinets, provide drug information to Physicians and Nurses and participation on the Cardiac Arrest Team.

The inpatient staff pharmacists also provide a variety of clinical services such as aminoglycoside and vancomycin kinetic dosing, renal dose adjustments, therapeutic interchanges, IV to PO conversions and antimicrobial management through the Patient Focused Care Program.

The Inpatient Operations Team also participates in many educational initiatives including the training of pharmacy technician students, pharmacy students and pharmacy residents.

Inpatient Operations Management Team

- John Clark, Associate Director
- Brian Callahan, Manager, Inpatient Operations
- Marcee Chote, Technical Coordinator
- Susan Crowe, Lead OR Pharmacist
- Annette Davis, Technical Coordinator
- Lisa Ginsberg-Evans, Supervisor, UH Pharmacies
- Denise Glenn, Manager, Mott Pharmacy
- Kathy Kinsey, Educational Coordinator
- Mike Kraft, UH Clinical Coordinator
- Annie Martin, Technician Trainer
- Deb Pasko, Mott Clinical Coordinator

Key Accomplishments/ Improvement Initiatives

- Implementation of UM-CareLink physician order entry system in Mott Hospital
- Planning and preparation for UM-CareLink activation in University Hospital
- Opened Mott Children's Hospital OR pharmacy satellite
- Opened a pharmacy satellite in the new Cardiovascular Center Pharmacy
- Implemented a new "cartless" medication distribution system in the Cardiovascular Center
- Revised IV policies and standards to improve compliance with USP 797 Guidelines
- Implemented revised annual media fill test competency to evaluate staff sterile IV admixture technique
- Constructed a new central IV Room that has been certified as being compliant with USP 797 standards
- Established a new mentorship program for newly hired pharmacists
- Initiated pharmacy compounding of continuous pediatric tube feeds with electrolytes added to improve patient safety
- Began providing pharmacy services to 24 hour short stay Post-Op recovery patients
- Developed a standardized protocols and policy for administration of contrast media
- Recruited and hired Lead OR Pharmacist
- Recruited and hired afternoon shift Technician Coordinator
- Partnered with Nursing and Medical leadership to improve management of peri-operative antimicrobial therapies
- Designed future ED Pharmacy Satellite

Inpatient Pharmacy Statistics

- **3.1 million** prescription orders processed per year
- **21,000** doses of oral medications dispensed per day
- **5,200** doses of intravenous medications dispensed per day
- **1.4 million** doses of medications packaged per year
- **25,600** chemotherapy products prepared annually

MEDICATION USE SYSTEMS

The Medication Use Systems Pharmacy Services is based out of the B2 pharmacy area. This section of the Department of Pharmacy Services is responsible for a wide variety of services to both internal (inpatient satellite pharmacy staff) and external (Omnicell end users, clinic staff) pharmacy customers.



Medication Use Systems Pharmacy Services Management Team Members:

John Clark, Associate Director
Barb Higgins, Manager, Medication Use Systems
Kim Landini, Manager, B2 Pharmacy Services
Diane Shoemaker, Technician Coordinator
Rusty Kalmbach, Technician Coordinator
Susan Garrett, Purchaser
Jeremy Dornbos, Purchaser
Paula King, Database Integration Technician
Dawn Caldwell, Technician Scheduler/Recruiter
Stephanie Brooks, MCIT pharmacy support liaison for Omnicell

Responsibilities of the Team:

- Procuring all medications from wholesalers and direct manufacturers
- Processing all medications into Omnicell Pharmacy Central (OPC) vertical carousels
- Maximizing the use of OPC software to better manage inventory turns and PAR levels
- Restocking majority of the over 120 Omnicell Unit Based Cabinets (UBC) with collaboration of staff in inpatient drug distribution area for stockouts and the 24 cabinets in the cardiovascular center (CVC).
- Processing and dispensing all controlled substances through the B2 Vault
- Annual controlled substances inventory process for inpatient medication supplies and ambulatory clinics
- Packaging bulk doses of controlled and non-controlled substances
- Compounding PCA syringes and all other sterile laboratory compounds including glycerin, Monosodium Glutamate, Pericardial patch solution, etc...
- Assembling user activated piggybacks for use in Omnicell UBC
- 3 times per week bulk compounding activities
- Servicing all on site and offsite clinic medication needs through the requisition process
- RobotRx functionality and upkeep for filling the UH cartfill
- Maintenance of current line items, new additions, deletions and new templates for LabelSafe labeling software
- All filling and distributing of medication Kits and Boxes
- TempTrak refrigerator monitoring system for inpatient medication refrigerators
- New entries, changes, and deletions in WORx pharmacy computer order entry system and Omnicell Pharmacy Central Carousel system
- Assistance with discrepancy resolution for Omnicell UBC

Accomplishments for 2006-2007

Numbers At A Glance

- *Installation of 24 Omnicell UBC in CVC—12 new and 12 relocated
- *Exchanged 140 old arrest boxes with 400 new boxes; new design & stock modifications
- *Packaged 550,000+ bulk tablets into unit dose packaging
- *Compounded 9500+ PCA syringes
- *Assembled 40,000+ user activated piggybacks
- *Improved LabelSafe appearance for 800+ new labels processed through this software

- Improved use of OPC software to better manage medication inventory and workflow related to medication movement. Await Beta trial of new OPC software platform for needed improvements
- Shuffled staffing FTE to provide 24/7 coverage of OPC carousels during evening shift so satellite pharmacy staff members did not need to travel to B2 to retrieve stock.
- Interface added from Robot to OPC for drugs not stocked in Robot but needed to complete cartfill.
- Through Database Integration Workgroup identified the need for Database Integration Technician to be instrumental in managing the OPC and WORx databases.
- Incorporated use of email notification into LabelSafe to identify use of restricted generic labels and times when barcode technology have been overridden.
- Recruited and implemented a scheduling/recruiting technician for inpatient pharmacy technicians. Improved scheduling process and scheduling software utilization.
- Recruited and implemented a lead technician for the B2 Vault.
- With the support of MCIT pharmacy, participated in a successful trial of a cartless system for drug distribution that paved the way for current drug distribution system for the CVC inpatient units.
- Identified override vs non-overridable meds within the Omnicell system; currently working with nursing to implement changes.
- Implemented expiration date tracking and checking of Omnicell cabinets. These changes were presented to ARRC.
- Recruited a midnight shift technician coordinator.
- Implemented B2 Omnicell for better streamlining of controlled substance movement on evening shift for Omnicell UBC restocks and critical lows.
- Improved exchange of Ambulance RSI boxes.
- Improved TempTrak monitoring of inpatient and inpatient like venue medication refrigerator temperatures. Added new sensors, exchanged old batteries, improved process for action when temp out of range, identified fridges without sensors, changed ranges to better reflect daily/hourly changes. These changes were presented to ARRC.
- Improved services to Omnicell cabinets by eliminating voicemail system for issues and collaborating with satellite pharmacies and technician coordinator on call for stock out filling when requested.
- Improved daily controlled substance adds process by adding another report at 1530 to catch daily adds that would otherwise have had to wait until the next morning.

- Eliminated all “first dose from Omnicell” dosing reducing double billing from cartfill and Omnicell.
- Placed IV ranitidine IV piggybacks in Omnicell to decrease the number dispensed from the pharmacy only to be returned the next day for IV/PO orders that had been given PO.

CLINICAL PHARMACY SERVICES

The Department of Pharmacy Services provides pharmaceutical care to both inpatients and outpatients. Clinical pharmacists function as integral members of health care teams at both University Hospital and C.S. Mott Children's Hospital, working with physicians to achieve desired therapeutic outcomes, prevent or minimize drug-related problems, and improve medication use. Currently, 30 clinical pharmacists, including 2 new positions (Transplant and Hematology/Oncology) added in FY2006, practice full time providing direct patient care services. In addition, a clinical practice model for staff pharmacists, implemented in 2005, continues to move forward. This model expands the role of the staff pharmacist beyond pharmacy operations, enabling them to participate in direct patient care activities.



**Paul C. Walker, Pharm.D.
Clinical Pharmacy Manager**

Pharmacists actively participate in the development, implementation and enforcement of drug use guidelines, policies and procedures, help to ensure appropriate use of high-risk medications, and serve on quality improvement committees throughout the institution. Specific departmental programs help assure cost-effective and appropriate use of high-risk or high-cost medications:

- *The High Impact Drug Monitoring Service.* In response to the growing number of biotech and other high-cost drugs that significantly impact the costs of care and the institution's margin, a High Impact Drug Monitoring Service was implemented in 2005 to help manage the use of targeted drugs. Drugs planned to be managed by the service include: Recombinant Factor VIIa; Darbepoetin; Drotrecogin; Fenoldopam; Filgrastim; and Intravenous Immune Globulin.
- *The Antimicrobial Restriction Program (ARP).* This program, implemented in 1997 to help manage rising antimicrobial expenses and escalating microbial resistance rates, evaluates the use of targeted antimicrobials on a case-by-case basis. Four clinical pharmacists specifically monitor the use of restricted antimicrobial agents to ensure appropriate use and make interventions as necessary. The ARP continues to help maintain pharmaceutical costs and attenuate or reduce microbial resistance rates.

In collaboration with the Department of Internal Medicine's Hospitalist Service, we piloted a Pharmacist-Facilitated Discharge process to provide medication reconciliation at discharge and address issues in transitional care that contribute to medication-related adverse events post-discharge. A clinical pharmacist interviews scheduled for discharge, assesses discharge medications; reconciles pre-admission and discharge medications to identify and resolve discrepancies; ensures that a follow-up plan for medication monitoring is identified and communicated to the patient, when appropriate; verifies that medications are covered by the patient's insurance plan; provides medication counseling, including written medication information; verifies patient comprehension with medication instructions; identifies and addresses potential adherence concerns; communicates a reconciled medication list to the patient's follow-up provider; and provides post-discharge follow-up by phone to assist patients with medication-related problems and concerns.

Other clinical initiatives and quality improvement projects undertaken by clinical pharmacists this year include the following:

- Participated in the implementation and evaluation of 2 Keystone Projects, specifically the Ventilator Bundle for the Medical ICU and the Sepsis Bundle.
- Compiled Infection Control and Epidemiology data for the hospital's annual antibiogram
- Conducted JCAHO readiness teaching rounds for anesthesiology fellows and residents

- Converted OR areas from dolasetron to generic ondansetron
- Converted OR's to vecuronium as the primary intermediate NMB
- Coordinated the opening of the new Mott OR Pharmacy Satellite
- Created safety information sheets for use of heparin in Mott OR
- Developed a lung transplant protocol website
- Developed a policy for pulse oximetry on all adult post-operative patients
- Developed a proposal for a pharmacist-managed heparin management service
- Developed a sedation medication teaching module for sedation credentialing
- Developed a steroid-avoidance immunosuppression protocol for kidney transplant recipients
- Developed an ethanol-lock protocol for Mott Hospital
- Developed and implemented a Medication Refill Technician position in the Turner Geriatric Clinic to respond to the majority of refill and prior authorization requests from patients to improve workflow at the clinic
- Developed and implemented a blood pressure protocol to improve hypertension management in ambulatory patients at the Brighton Health Care Center
- Developed and implemented a physician survey to identify potential barriers to blood pressure control in ambulatory patients
- Developed and implemented a protocol for daily interruption of sedative infusions in the TBICU.
- Developed and implemented a standardized alcohol withdrawal treatment protocol
- Developed and implemented guidelines for intra-operative and ICU use of factor VIIa
- Developed and implemented recommendations for therapeutic alternatives during antimicrobial drug shortages.
- Developed Guidelines for antimicrobial prophylaxis and treatment in hematology patients
- Developed guidelines for the appropriate use of alvimopan in the prevention of post-operative ileus.
- Developed guidelines for use of hypertonic saline
- Developed pediatric insulin guidelines for the OR
- Developed transfer order sets to facilitate patient transfer from PICU to OR
- Evaluate feasibility of creating a pharmacist-driven vancomycin and aminoglycoside driven protocol at Mott
- Evaluated erythropoietin use in the SICU to help define guidelines for use in the anemia of critical illness
- Evaluated the clinical and economic outcomes of thymoglobulin induction in living unrelated kidney transplant recipients
- Evaluated the impact of a hyperglycemia protocol in TICU
- Facilitated procedures for anesthesia equipment storage in omniceils
- Finalized the pediatric electrolyte protocol
- Helped develop and implement the "Empiric therapy for hospital acquired pneumonia/ventilator associated pneumonia/sepsis" protocol
- Helped develop and implement the "SICU admission order set,"
- Helped develop and implement the a sedation protocol in the SICU
- Helped develop and implement the SICU electrolyte replacement protocol
- Helped develop standard protocols and practice consensus for the management of inpatient hematology patients to ensure safety and efficacy of treatments as well as decrease overall cost
- Helped edit the TICU Handbook of protocols for commonly used TICU procedures and medications
- Helped to improve performance on diabetes management indicators in our ambulatory clinics
- Implemented a "Clinical On-Call" pager process for UH
- Implemented a process for compounding vancomycin oral solution from intravenous product
- Improved ordering and monitoring of heparin in the Medical ICU

- Initiated a cholesterol project aimed at improving LDL cholesterol in diabetic patients and assessing the impact of a pharmacist in this area of practice
- Initiated development of guidelines to address the inappropriate use of proton pump inhibitors in medicine patients.
- Initiated therapeutic substitution guidelines for the Transplant Center
- Led change to use of commercially available CRRT solutions
- Participated in “On the Road to Improving Treatment of Sepsis”
- Participated in “Preventing VAPs...A Tale of Two Units”
- Participated in development and implementation of a low molecular weight heparin bridging program
- Participated in development of numerous order sets for the CareLink project, including chemotherapy order sets and order sets for pediatric and neonatal TPN
- Participated in efforts to identify optimal nicotine replacement therapy in all patients admitted to UH who have history of smoking
- Participated in efforts to improve DVT prophylaxis
- Participated in the health system’s statin switch initiative
- Participated in the Mott hospital design development team
- Participated in the PSI pilot with CIDSS
- Participation with the development of sedation protocol for the PCTU
- Provided ongoing consultative support for Mott syringe pumps
- Reviewed standard morphine infusion guidelines for PTCU
- Revised neutropenic fever guidelines
- Revised the UMHS Antiemetic Guidelines
- Revised therapeutic range and reporting process for digoxin
- Set up a procedure for EEG lab in pediatrics to procure medications
- Taught CPR classes to all new pharmacy staff, including residents
- Updated and revised code medicine procedures for offsite clinics
- Updated *Clostridium difficile* colitis guidelines
- Updated endocarditis treatment guidelines
- Updated Mott anesthesia medication trays
- Updated the Infection Control policies to address medications in a sterile field
- Updated the lung transplant protocols for immunosuppression, infection prophylaxis, transplant rejection, and the TICU Lung Transplant Critical Pathway
- Updated the UMHS Antimicrobial Handbook
- Updated weight based dosing guidelines for antibiotics used in surgical prophylaxis
- Worked with medical assistants and physicians on how to perform self-management goal setting with patients, incorporating self-management goal sheets into practice at the Brighton Health Center

Pharmacists as integral members of health care teams, actively participate in the development, implementation and enforcement of drug use guidelines, policies and procedures, help to ensure appropriate use of high-risk medications, and serve on quality improvement committees throughout the institution.

DUE Projects Initiated and/or Completed In The Last Year

- Bevacizumab Use Evaluation
- Co-Administration of Quinolone Antibiotics with Divalent Cations
- Darbepoetin/Erythropoietin Use Evaluation
- Evaluation of Antipsychotic Drug Use in Demented Elders
- Evaluation of Factor Viia Use in Pediatric Patients.
- Evaluation of Post-Operative Antimicrobial Prophylaxis Following Implantation of Left Ventricular Assist Devices

- Evaluation of Post-Operative Vancomycin Prophylaxis In Patients Undergoing Cardiothoracic Surgery
- Evaluation of the Use of Antifungal Agents in Organ Transplantation
- Panitumumab Use Evaluation

Committee Participation

Clinical pharmacists served on the following hospital committees, work groups and task forces:

- Academic Chronic Care Collaborative
- Ad hoc Committee to develop TPN nutrition order sets for Carelink.
- Advisory Board of the Diabetes Education Program
- Brighton Health Center Diabetes Project Committee
- Cancer Pharmacy Committee
- Cardiac Group
- Cardiology Quality Assurance Committee.
- Committee on Pain and Sedation
- Congenital Heart Center Joint Practice
- Content and Knowledge Subgroup Committee (part of Orders Management Project)
- Critical Care Committee
- Diabetes Mellitus Quality Improvement Task Force
- Geriatrics Center Clinical Advisory Committee
- Glycemic Management Subcommittee of the Pharmacy & Therapeutics Committee
- Hematology Standard of Care Committee
- Holden Joint Practice Committee
- Joint Practice Committee for Pediatric Critical Care/Surgery
- Kidney/Pancreas Transplant Operations Committee
- Liver Transplant Continuous Quality Improvement Committee
- Liver Transplant Policy Committee
- Medication Reconciliation Steering Committee
- Operations Workgroup of Turner Geriatric Clinic
- Patient Education Advisory Committee
- Patient Education Oversight Committee
- Pediatric CPR/RRT Committee
- Pediatric Medication Safety
- Pediatric Nurse Network
- PGIP Coronary Artery Disease Steering Committee
- PGIP Diabetes Steering Committee
- Pharmacist-facilitated Discharge Team
- Pharmacy and Therapeutics Committee
- UMHS Clinical Care Guidelines – Diabetes Guideline Team

Pharmacy also participated in the planning committee for the new pediatric hospital.

AMBULATORY PHARMACY SERVICES

Ambulatory Pharmacy Services encompass three separate outpatient pharmacies as well as two infusion pharmacies. The infusion pharmacies are located in the Cancer Center and the Canton Health Center. In addition to dispensing functions, the pharmacy staff supports many pharmaceutical care activities for the University of Michigan Hospitals and Health Services (UMHHS) ambulatory areas. All pharmacies provide the following services:

- Clinical review of prescription
- Physician consultation and drug information provision
- Patient consultation
- Reimbursement assistance



Art Poremba, RPh, MS
Ambulatory Pharmacy Services
Manager

Outpatient Pharmacies

The Ambulatory Care Pharmacy and the Cancer Center Pharmacy are located on the main campus, adjacent to the University Hospital. A third pharmacy services our East Ann Arbor Health Center. The population served by these pharmacies include those patients receiving care from UMHHS, patients discharged from the hospital and/or our emergency department and employees. A customer satisfaction survey of employees, dependents and retirees was conducted by the University Staff Benefits Office for those individuals who utilized the Employee Prescription Plan. This survey reflected our dedication to patient services with the University of Michigan pharmacies ranked highest in terms of customer satisfaction.

Ambulatory staff provide consultative services to approximately 115 ambulatory sites related to compliance with medication management standards. Sites frequently contact pharmacy staff for assistance with new drug availability, reimbursement support and individual patient drug related support. Additional services include the training of site staff to complete self-review for accrediting agencies, annual on-site consultation visits, and tracking of compliance with monthly self inspections. The process of self-evaluation, with appropriate validation, has increased monthly site inspection compliance rates from 45% to 98%.

Ambulatory pharmacy representatives participate on several committees including:

- Ambulatory Formulary Committee
- Lean process improvement efforts in the following areas:
 - Discharge medication process
 - Cancer Center Infusion workflow, proactive problem solving and increasing technology usage.
- Cancer Center Pharmacy Committee
- Cancer Center Clinical Operations Committee
- Cancer Center Operations Committee
- Cancer Center Quality Improvement Committee
- University of Michigan Pharmacy Benefits Committee

- Ambulatory Services JCAHO Readiness Committee

In addition to these activities, ambulatory pharmacy staff are involved in iCARE – the University of Michigan’s academic detailing program, as well as initiatives to improve the cost and quality of pharmacy services provided to university employees, dependents, and retirees with a prescription drug benefit carve-out.

Pharmacy Demographics and Services

| | |
|---|---|
| <p>Ambulatory Care Pharmacy</p> | <ul style="list-style-type: none"> • Prescription volume = 300 / day • Utilizes ScriptPro automation • Discharge prescriptions account for 20% of volume • Compounding services provided-generally about 5 compounds per day • Generic dispense rate equals 60% which exceeds standards • Utilize coaster patient paging system to inform patients of prescription status. |
| <p>Cancer Center Pharmacy</p> | <ul style="list-style-type: none"> • Prescription volume = 125/ day • Supports a high volume of investigational drug protocols • Generic dispense rate equals 60% which exceeds standards |
| <p>East Ann Arbor Pharmacy</p> | <ul style="list-style-type: none"> • Prescription volume = 100 / day • Supports U of M speciality pharmacy program • Generic dispense rate equals 65% which exceeds standards • Implementation of WebIDS software to support investigational drug studies. |
| <p>Cancer Center Infusion Pharmacy</p> | <ul style="list-style-type: none"> • Supports 50 patient chairs/beds, representing 130-180 patients per day • Approximately 35,000 infusion procedures annually • Significant support provided for investigational drug protocols • Utilizes Phaseal technology to safeguard employees from chemotherapy exposure • Emphasis on patient safety by tracking compliance with independent pharmacist double checks of new orders entered. Results indicate 98-100% compliance • Pharmacists monitor patient laboratory results and recommend dose adjustments when appropriate • Provide nursing education for new medication |

**Canton Health Center
Infusion Pharmacy**

- Opened in June 2006
- Primary support is for oncology patients; however other infusion needs are also supported
- Capacity is 9 chairs. Average number of patients per day is 15. Goal is 25 patients per day.
- On-site infusion pharmacy services

MEDICATION SAFETY

The Institute of Medicine's Report, *To Err is Human*, initiated waves of activity throughout the healthcare industry. Wishing to be at the forefront of this movement, the Department of Pharmacy Services decided in 2000 to dedicate a full time pharmacist to monitor and minimize, where possible, the potential of serious adverse drug events. The Medication Safety Coordinator for the department focuses his attention on a variety of activities. Working in close collaboration with the Risk Management Department, the coordinator reviewed over 2500 reported medication incidents in the past fiscal year. Though most reports originate from the hospitals, medication incidents are reported from throughout the University of Michigan's Healthcare Centers, including offsite clinic locations such as Brighton and East Ann Arbor. Each report is reviewed and classified by the coordinator as to level of harm and contributing factors that likely caused the incident. Pharmacy-related errors (approximately 17% of the total reports) precipitate a more exhaustive review. Whenever possible, the coordinator notifies those staff members involved with the incident and seeks their input as to system and personal changes that can be made to minimize the potential of a similar event in the future. This type of collaborative, non-punitive interchange of ideas has stimulated many changes, some of which include:

- Revision or addition of dose check alerts.
- Warning alerts for drug interactions with a high potential for harm.
- Changes in the process flow of preparing medications.

Medication Safety Committee (MedSafe)

The Medication Safety Committee is a multi-disciplinary group of clinicians who are dedicated toward improving the safe use of medications throughout our healthcare environment. The committee is represented by medical, pharmacy, and nursing staffs as well as members from Risk Management, Quality Improvement, and HomeMed. The committee, which meets bi-monthly, is advisory in nature and reports directly to the hospital's Pharmacy and Therapeutics Committee. MedSafe engaged in a wide range of activities during the past fiscal year. Some of these include:

- Participated in work efforts to maintain compliance with external regulatory requirements (including JCAHO and CMS).
- Participated in the pediatric medication safety Failure Mode and Effect Analysis (FMEA) which directed the improvement and standardization of pediatric medication prescribing, dispensing and administration.
- Initiated prospective reviews of potential medication safety issues.
- Continued to analyze medication error data and trends for the quarterly quality report summarized and submitted to the Medical Executive Board and to the Hospitals and Health Centers Executive Board.
- Heparin safety changes made in Mott Hospital. These were made in response to the deaths that occurred at another hospital.

Primary Goals of the Medication Safety Committee

1. Reduce error rates for error-prone processes
2. Review and Analyze Adverse Drug Reactions
3. Review and Analyze Medication Errors
4. Conduct External Data Reviews
5. Promote and Conduct Staff Education
6. Enhance Medication Error Reporting
7. Cultivate a Non-punitive Environment

- 10 unit/ml heparin vials from 5EMC, 6M, 6CAP, PCTU, Pod B, Pod C, and MPACU removed
 - 100 unit/ml heparin vials from Pod C removed
 - 1000 unit/ml heparin vials from 5EMC, 5E, 5W, 6M, and MPACU removed
 - Switch the 1000 unit/ml heparin multi-dose vials to the 1ml single dose vials in NICU (rooms 1-4), PCTU, Pod B, Pod C, and 7M. Place the single dose vials in high security bins with alerts stating that you are using the 1000 unit/ml strength of heparin
 - 25000 unit/250ml premixed bags from 5EMC and 5E removed
 - Mott pharmacy will stock NICU (rooms 2-3) with 2 art line bags of D10 500ml with 500 units of heparin, to be exchanged daily due to 30 hour expiration.
 - ECMO will dispense the heparin bolus for all ECMO patients; they will still have the multi-dose vial of 1000 unit/ml heparin in their ECMO carts.
- Develop a mechanism for nursing to document fentanyl-patch placement on each shift. The documentation is required due to incident trends that showed patients either had multiple patches (old patch not removed) or no patch (patch fell off). Nursing to document patch replacement directly on the MAR.
 - Highlight to the P&T committee recent trends of promethazine induced phlebitis seen by the Vascular Access Service (VAS) and the Institute for Safe Medication Practices (ISMP) serious cases of tissue damage and suggested dosage changes.
 - Presentation to the Information Technology Strategic Advisory Committee (ITSAC) on the Barcoded Medication Administration as part of the capital equipment request process

Members of the MedSafe committee include:

| | |
|-----------------------------------|---|
| Karen Adkins-Bley, RN | Risk Management |
| Desiree Blake, RN, MPH | Educational Nursing Services |
| Scott Ciarkowski, RPh, MBA | Medication Safety Coordinator |
| Elaine Commiskey, BS, MS | Risk Management |
| John Gosbee, MD, MS | Patient Safety Process Consultant |
| Hilary King, RN | Staff Specialist – Nursing Cardiovascular |
| Mickael Lukela, MD | Pediatrics Staff |
| John Mitchell, PharmD | Former Medication Safety Coordinator |
| Shawn Murphy, MSN, RN | Director of Nursing |
| Mark Pearlman, MD | Medical Staff / OCA |
| Patricia Sirois, PharmD (HomeMed) | HomeMed |
| Jim Stevenson, PharmD, FASHP | Pharmacy Director |
| Maureen Thompson, MSN, RN, CCRN | Patient Safety Coordinator, OCA |
| Linda Ziesmer, RN, MPH, MS | Quality Improvement Operations Director |

Interdepartmental Activities

Medication Safety belongs to every member of the healthcare team who comes into contact with our patients. Risk Management plays a large role in providing a content-rich database for all reported patient safety incidents, including medication safety reports. The medication safety coordinator meets with members of the risk management team and nursing on a regular basis to discuss both individual significant events and cumulative data that suggest trends requiring the attention of MedSafe. Patient Safety Rounds are conducted bi-weekly and headed by the Office of Clinical Affairs (OCA). These rounds provide an avenue for staff members to voice issues and concerns regarding systems that may subject a patient to errors. The medication safety coordinator is a permanent member of this rounding team.

Serious adverse events and sentinel events result in the activation of multi-disciplinary teams that investigate the facts surrounding the event, determine the root cause(s) of the event, and develop an

action plan to minimize the likelihood of the event reoccurring. This team is launched after a review by OCA and usually includes physicians, pharmacists, nursing, risk management, and quality improvement. Other disciplines may be included as the event warrants.

Quarterly reports are developed for the Continuous Quality Improvement Program Lead Team in consultation with quality improvement, risk management, pharmacy, and nursing.

Medication Safety Contributions

The University of Michigan Pharmacy Department thanks John Mitchell for the many medication safety improvements that have been implemented within the University system over the past several years. In addition, John's moving an idea to reality and increased awareness of medication safety issues with staff members, new employees, and pharmacy students have made the hospital environment safer for patients. It is with regret that John has moved to another position but we send well wishes as he will have the opportunity to provide expertise and knowledge in a new area and enrich others.

We welcome **Scott Ciarkowski** as John's replacement as the Medication Safety Coordinator.



**Scott Ciarkowski,
B.S. Pharmacy, M.B.A.**

Medication Safety Coordinator

RESEARCH AND EDUCATION

Part of the mission of the Department of Pharmacy Sciences is to share knowledge with our peers and one way that this is accomplished is by conducting research and publishing these results in peer reviewed journals. We maintain our reputation of excellence by showing leadership in scholarly activity.

Research

The Department's research covers a wide range of inpatient and outpatient drug and disease state management, pharmacokinetics, and pharmacogenomics. In addition to conducting research itself, we mentor future researchers through our work with residents, pharmacy students and fellows.

| Pharmacy Residency Class 2006-2007 | |
|---|--|
| Specialty | Pharmacy Practice |
| Dorothy Surowiec (Infectious Diseases) Peter Schlickman (Heme/Onc) P. Neil L. Edillo (Informatics and Technology) Dina Mohammad (Critical Care) | Jennifer L. Ludwig: James T. Miller Kristen T. Reaume Valerie A. Sanluis Shawna L. VanDeKoppel |
| Pharmacy Residency Class 2007-2008 | |
| Specialty | Pharmacy Practice |
| David Hutchinson (Pediatrics) James Miller (Critical Care) Jason Pogue (Infectious Diseases) Kristen Reaume (Cardiology) Shawna VanDeKoppel (Oncology) | Carrie Nemerovski Sacha Pollard Stephen Stout Kelan Thomas |

Additionally, there were approximately 97 Pharm.D. student investigations projects last year within the College of Pharmacy precepted by members of our Department.

Grants

The Department of Clinical Sciences' Faculty had grants totaling \$1,308,403.00 in fiscal year 2006-2007.

Funded Fiscal Year, 2007

| INVESTIGATOR | PI | SPONSOR | TITLE | DIRECT | INDIRECT | CURRENT PERIOD END |
|----------------------|------------------|--|--|-------------|-------------|--------------------|
| Bleske | Bleske | Astra Zeneca | The Effect of Paroxetine & Silfenadil on the Pharmacokinetics of Metoprolol & Carvedilol | (\$13,705) | \$13,793.00 | 5/30/07 |
| Carver | Carver | Merck | Caspofungin for the Treatment Candida Glabrata Blood Stream Infections (BSIs) | \$23,800.00 | \$5,950.00 | 2/28/08 |
| Choe/Remington/Wells | Shimp | UM Benefits Office/MI Healthy Initiative | Optimization of Drug Therapy Program (MHealthy Focus on Medicines) Program Development and Implementation | \$491,685 | 0 | 12/31/08 |
| Collins | Park | Genzyme Corporation | Clinical and economic outcomes of rabbit antithymocyte globulin induction in living unrelated renal transplantation. | \$12,000 | | 2007 |
| Collins | Steele, Brent J. | Kansas University | La Grippe and World War I: Conflict participation and pandemic confrontation. | \$7,000 | | 2006 |
| Collins | DePestel | Cubist Pharmaceuticals Inc | Cubicin outcomes registry and experience (CORE). | \$12,000 | | 2006 |
| DePestel | Mueller | Cubist | Pharmacokinetics of CUBICIN in Critically Ill Patients Receiving Continuous Venovenous Hemodialysis (CVVHD). | \$77,323 | \$19,331 | 5/31/2008 |

| | | | | | | |
|-----------|-----------|------------------------------|---|-------------|-------------|------------|
| DePestel | DePestel | Westat | CUBICIN Outcomes Registry and Experience (COREv.3) for the Treatment of Serious Gram-positive Infections. | \$8,911 | \$989.00 | 6/30/07 |
| Ellingrod | Ellingrod | College/Upjohn Award | Genetic Predictors of Antipsychotic Associated metabolic Syndrome | \$15,000 | 0 | 1/31/2008 |
| Erickson | Erickson | Blue Cross Blue Shield of MI | Perceived Health Status and Severity of Illness: Differences Between the Genders | \$10,000.00 | 0.00 | 07/01/10 |
| Guthrie | Domino | NIH | Effects of Nicotine on Human Cerebral Transmitters | \$4,592.00 | \$2,388.00 | 08/31/07 |
| Johnson | Johnson | For Health Technologies | Stability of Parenteral Dolasetron, Vecuronium and Ethanol in Polypropylene Syringes | 0 | 0 | 10/31/07 |
| Mehta | MedSchool | NIH | K12 Grant | 0 | 0 | 8/31/07 |
| Mueller | Mueller | Merck | Invanz™ Clearnace in Continuous Renal Replacement Therapy (CRRT) An In-Vitro Investigation | \$154,226 | \$8,733 | 10/31/2007 |
| Mueller | Mueller | Cubist Pharmaceuticals | Intradialytic Daptomycin Administration and Protein Binding in Chronic Hemodialysis Patients | \$76,903.00 | \$19,226.00 | 8/20/2007 |
| Mueller | Mueller | Cubist | Pharmacokinetics of Cubicin in Critically Ill Patients Receiving Continuous Venovenous Hemodialysis (CVVHD) | \$77,323.00 | \$19,331.00 | 05/31/08 |

| | | | | | | |
|--------------|-------------|--|---|--------------------|------------------|-----------|
| Park | Park | Roche Laboratories | Pharmacokinetics of Mycophenolate Mofetil Alone and in Combination with Valganciclovir in Renal and Heart Transplant Recipients | \$19,200 | \$4,800 | 7/31/07 |
| Shimp | Remington | CRLT | Incorporating Education on Motivational Interviewing into the Pharmacy Curriculum | \$6,000.00 | \$6,000.00 | |
| Shimp | Kucukarslan | UM Benefits Office/MI Healthy Community Initiative | Incorporating Education on Motivational Interviewing into the Pharmacy Curriculum | \$196,899 | 0 | 12/31/08 |
| Siden | Wicha | NIH | University of Michigan Comprehensive Cancer Center Support Grant | | | 5/31/07 |
| Stevenson | Stevenson | Allergan | To support Pharmacy Grand Rounds at the hospital | \$15,000 | | 2007 |
| Welage | Med School | NIH | K30 Drug Development Grant | \$0 | \$0 | 5/31/2007 |
| TOTAL | | | | \$1,207,862 | \$100,541 | |

**Department of Clinical, Social and Administrative Sciences
Publications Highlights, 2006-2007**

Book, Book Chapters and Books Edited

Berardi RR. Inflammatory Bowel Disease, in Helms RA, Quan DJ, Herfindal ET, et al (eds): Textbook of Therapeutics: Drug and Disease Management. Lippincott Williams & Wilkins, Baltimore, 8th edition, 2006.

Berardi RR. Disease Management Cases: Gastrointestinal Disorders, in PharmPrep, American Society of Health-System Pharmacists, 3rd Edition, 2007.

Bleske BE, Koch E, Aarronson K. Boluyt MO. Hawthorn and Heart Disease. In press-The Encyclopedia of Herbal Medicine in Clinical Practice, CABI Publishing.

Kraft MD, Btaiche IF. Parenteral nutrition. In: Chisholm MA, Schwinghammer TL, Wells BG, et al., eds. Pharmacotherapy Principles & Practice, 1st ed. McGraw-Hill Medical; 2007:1493-510.

Btaiche IF. Adult Nutrition Support Core Curriculum: A Case-Based Approach-The Adult Patient, 2nd Edition The American Society for Parenteral and Enteral Nutrition. Silver Spring, MD.

Carver, PL. "The Ubiquitous Roles of Cytochrome P450 Proteins", Vol. 3 of Metal Ions in Life Sciences", A. Sigel, H. Sigel, R.K.O. Sigel, Eds.; John Wiley & Sons, Ltd., Chichester, UK, 2007, 3:591-617.

Christen C. A History of Medication Errors Published Over the Last Forty Years. Ann Pharmacother. 2006; 40:2020-1.

Frame D. Chemotherapy Induced Nausea and Vomiting: Treatment Guidelines in Cancer Support 2007, McMahan Publishing

Guthrie SK, Brower KJ, Karam-Hage M. Substance-related disorders. In: Pharmacotherapy Essentials. Eds. MA Chisholm, TL Schwinghammer, BG Wells, JT DiPiro, JM Kolesar, PM Malone. McGraw-Hill, New York, 2006 – July.

Khalidi, N. Book Review and Assessment for Publication: "Law and Ethics for Technicians", Thomson, Delmar Learning, Clifton Park, NY, 2007.

Kraft MD and Btaiche IF. Parenteral Nutrition. In: Malone P, et al., eds. Pharmacotherapy Principles and Practice, 1st ed. 2006.

Regal RE. Editor/Monograph reviewer, Mosby's Nursing Pharmacology Monographs, 2007. Multiple sections. 2. Editor/Monograph reviewer, Omnicare Geriatric Pharmaceutical Care Guidelines, 2007 edition. March-April, 2007 3. Guest Editorial Advisor for MacDougall, C. Fluoroquinolone Update. The Rx Consultant. Volume XVI Number 5. CE Approved. 4. Grant Application Reviewer. "The effects and costs of cranberry use to prevent clinical urinary tract infections in nursing home residents" Health Care Efficiency Research Programme (The Netherlands)

Shimp LA, Smith MA. Pregnancy Prevention and Contraception (Chapter 27) in Sloane PD, Slatt LM, Ebell MH, Jacques LB, Smith MA (editors) Essentials of Family Medicine (5th edition) 2007

Walker PC. Diarrhea. In Berardi RR, Kroon LA, McDermott JH, et al (eds.) The Handbook of Non-Prescription Drugs. 15th Edition. American Pharmacists Association, Washington, D.C. 2006.

Peer-Reviewed Articles

Stumpf JL, Skyles AJ, Alaniz C, Erickson SR. Knowledge of appropriate acetaminophen doses and potential toxicities in an adult clinic population. J Am Pharm Assoc. 2007;47:35-41.

Alaniz C, Janusz J. A retrospective study of the etiologies and outcomes of patients admitted to a university hospital with presumed acetaminophen toxicity. Hosp Pharm. 2007;42:126-132.

Eschenauer GA, Fedewa K, **Collins CD, Alaniz C**. Compliance with an institutional guidelines on the use of vancomycin in a medical intensive care unit. Hosp Pharm. 2006;41:749-53.

Berardi RR. Advances in gastrointestinal pharmacotherapy –Who would have thought? Ann Pharmacother. 2007;41:1053-55.

Bleske, BE. Hwang HS, Zineh I, Ghannam MB, Boluyt MO. Evaluation of immunomodulatory biomarkers in a pressure overload model of heart failure. Pharmacotherapy 2007;27(4):504-509.

Ito MK, Cheung RJ, Gupta EK, Birtcher KK, Chong PH, Bianco TM, **Bleske BE**. Key articles, guidelines, and consensus papers relative to the treatment of dyslipidemia-2005. Pharmacotherapy 2006;26:939-1010.

Saad A, DePestel DD, Carver PL. Factors Influencing the Magnitude and Clinical Significance of Drug Interactions Between Azole Antifungals and Select Immunosuppressants. Pharmacotherapy 2006; 26(12):1730-44.

Saad A, DePestel DD, Carver PL. Author's reply to "Factors Influencing the Magnitude and Clinical Significance of Drug Interactions Between Azole Antifungals and Select Immunosuppressants." Pharmacotherapy 2007;27(4):e3-36.

Eschenauer G, **DePestel DD, Carver PL**. Comparison of Echinocandin Antifungals. Therapeutics and Clinical Risk Management 2007;3(1) 71-97.

Carver PL, Johnson MD. Advances in the Management of Invasive Fungal Infections. ASHP Continuing Education. Internet and text CE program. 2007, pages 15-21.

Choe HM, Townsend KA, Blount G, et al. Treatment and control of blood pressure in patients with diabetes mellitus. Am J Health-Syst Pharm. 2007;64:97-102.

Choe HM, Stevenson JG, Streetman DS, et al. The Impact of Patient Financial Incentives on Participation and Outcomes in a Statin Pill-Splitting Program. American Journal of Managed Care. Publication in *Am J Manag Care*. 2007;13(part 1):298-304).

Choe HM, Stutz D, Cooke D, et al. Improve Blood Pressure Control in Patients with Diabetes.

Cober MP, **Johnson CE**. Stability of an extemporaneous alcohol-free phenobarbital suspension. *Am J Health Syst Pharm* 2007;64(6):644-646.

Cober MP, Johnson CE. Otitis media: review of the 2004 treatment guidelines. *Ann Pharmacother*. 2005;Nov;39(11):1879-87.

Shehab N, **DePestel DD, Mackler ER, Collins CD**, Welch K, Erba HP. Institutional Experience with Voriconazole Compared to Liposomal Amphotericin B as Empirical Therapy in Adult Hematology Patients after Implementation of a Febrile Neutropenia Algorithm. *Pharmacotherapy*. 2007 Jul;27(7):970-979.

Collins CD, Eschenauer GA, Salo SL, Newton DW. To test or not to test: A cost-minimization analysis of susceptibility testing in patients with *Candida Glabrata* fungemias. *J Clin Microbiol*. 2007;45: 1884-1888.

Collins CD, Stuntebeck ER, DePestel DD, Stevenson JG. Pharmacoeconomic Analysis of Liposomal Amphotericin B versus Voriconazole for Empiric Treatment of Febrile Neutropenia. *Clin Drug Invest* 2007;27(4):233-241.

Borschel DM, Chenoweth CE, Kaufman SR, Hyde KV, VanDerElzen KA, Raghunathan TE, **Collins CD**, Saint S. Are Antiseptic-Coated Central Venous Catheters Effective in a Real-World Setting? *Am J Infect Control*. 2006 Aug;34(6):388-93.

DePestel DD, DePestel JM, **Walker PC**. Impact of Educational Interventions to Prevent Drug Interactions between Fluoroquinolone and Tetracycline Antibiotics and Supplements Containing Polyvalent Cations. In Press: Hospital Pharmacy, June 2007.

Collins CD, Stuntebeck ER, DePestel DD, Stevenson JG. Pharmacoeconomic Analysis of Liposomal Amphotericin B versus Voriconazole for Empiric Treatment of Febrile Neutropenia. *Clinical Drug Investigation* 2007;27:71-97.

Monto AS, **DePestel DD**. Facts or Fiction 2006: Influenza in America and Global Influences.

U.S. Pharmacist 2006; December (Suppl):1-14.

<http://www.uspharmacist.com/index.asp?page=ce/105382/default.htm>

Dorsch MP, Lee JS, Lynch DR, Dunn SP, et al. Aspirin resistance in patients with stable coronary artery disease with and without a history of myocardial infarction. *Ann Pharmacother* 2007; 41: xxxx. Published online April 24, 2007.

Butler SO, Dorsch MP. Antifibrinolytic agents in coronary artery bypass graft surgery. *UHC Drug Monograph*, March 2007.

Bishop JR, **Ellingrod VL**, Moline J, Miller. Association analysis of G-protein Beta3 Subunit Gene (C825T) polymorphisms with clinical response or olanzapine or olanzapine related weight gain in persons with schizophrenia. Med Sci Mon 2006; 12(2):BR47-50.

Bishop JR, **Ellingrod VL**, Moline J, Schultz SK (2006). Association between polymorphisms of the G-protein beta subunit (GNB3) and serotonin-2A receptor polymorphisms and sexual dysfunction in persons treated with an SSRI for depression. Neuropsychopharmacology;31(10):2281-2288.

Lin Ying-Chi, **Ellingrod VL**, Bishop JR, Moline J, Miller DD (2006). P-glycoprotein polymorphisms and olanzapine response in patients with schizophrenia. Ther Drug Monit; 28: 668-672.

Fiedorowicz JG, Moser DJ, Hynes SM, Beglinger LJ, Schultz SK, and **Ellingrod VL**. L_A Allelic Heterozygosity of the 5HTTLPR Polymorphism is Associated with Higher Cognitive Function and Lower Interpersonal Sensitivity. Psychiatric Genetics 2007;17(1):3-4.

Bishop JR and **Ellingrod VL** (2007). Metabotropic glutamate receptors as pharmacogenetic candidate genes in studies of current and future antipsychotic agents in schizophrenia. Current Pharmacogenetics; 5: 21-30.

Ellingrod VL, Bishop JR, Moline J, Miller D: Leptin and leptin receptor gene polymorphisms and increases in body mass index (BMI) from olanzapine treatment in persons with schizophrenia (2007). Psychopharmacology Bulletin; 40(1): 57-62.

Worsham J, **Ellingrod VL**, Bishop JR (2007). Review of sexual dysfunction associated with antidepressant use. Journal of the College of Psychiatric and Neurologic Pharmacists. Available at: <http://cpnp.org/docs/news/20070126.pdf>

Savona MR, Newton D, **Frame D**, Levine JE, Mineishi S, Kaul DR. Low-dose cidofovir treatment of BK virus-associated hemorrhagic cystitis in recipients of hematopoietic stem cell transplant. Bone Marrow Transplant. 2007 Apr 16, epub ahead of print

Frame D. Chronic myeloid leukemia: standard treatment options. Am J Health Syst Pharm. 2006 Dec 1;63(23 Suppl 8):S10-4)

Frame D. Update of VEGF inhibitors, 3 Part Series. Pharmacy Practice Nov, Dec, Jan

Scott DJ, Domino EF, Heitzeg MM, Koeppe RA, Ni L-S, Bueller JA, **Guthrie S**, Zubieta J-K. Smoking activation of μ -opioid receptor mediated neurotransmission. Neuropsychopharmacology 2007, 32:450-7

Cober MP, **Johnson CE**: Stability of an extemporaneous alcohol-free phenobarbital suspension. Am J Health-Syst Pharm. 2007;64 644-646.

Navarre N, Patel H, **Johnson CE**, Durance A, McMorris M, Bria W, **Erickson S**: Influence of an interactive computer-based inhaler technique tutorial on patient knowledge and inhaler technique. Ann Pharmacother. 2007; 41:216-21.

Green LA, Baldwin JL, Brinley FJ, Freer JA, Grum CM, Hurwitz ME, **Johnson CE**, Song B. 2006 Asthma (update). Ann Arbor, MI: Office of Clinical Affairs, University of Michigan Health System, 2006.

Klein KC, Blackwood RA. Topical voriconazole solution for cutaneous aspergillosis in pediatric bone marrow transplant patient. *Pediatrics* 2006;118:e506-e508.

Baillie GR, **Mason NA**, Elder SJ et al. Large variations in prescriptions of gastrointestinal medications in hemodialysis patients on three continents: the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Hemodial Int.* 2006;10:180-188.

Baillie GR, Elder SJ, **Mason NA** et al. Sexual dysfunction in dialysis patients treated with antihypertensive or antidepressive medications: results from the DOPPS. *Nephrol Dial Transplant.* 2007;22:1163-1170.

Bragg-Gresham JL, Fissell RB, **Mason NA**, et al. Diuretic use, residual renal function, and mortality among hemodialysis patients in the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Am J Kidney Dis.* 2007;49:426-31.

Kuiper SA, **McCreadie SR**, **Mitchell JF**, **Stevenson JG**, Medication errors in inpatient pharmacy operations and technologies for improvement. *Am. J. Health Syst. Pharm.*, May 2007; 64: 955 – 959.

McCreadie SR, ASHP Statement on the Pharmacist's Role in Informatics. Contributor. *Am J Health-Syst Pharm.* 2007:200-3.

Streetman DS, **McCreadie SR**, McGregory M, Ellis JJ., Evaluation of clinical research knowledge and interest among pharmacy residents: Survey design and validation. *Am J. Health-Syst Pharm.* 2006;63:2372-7.

Taber SS, **Mueller BA**. Drug-Associated renal dysfunction. *Critical Care Clinics* 2006;22:357-74.

Churchwell MD, **Pasko DA**, **Mueller BA**. Daptomycin clearance during modeled continuous renal replacement therapy. *Blood Purif* 2006 Nov 16;24(5-6):548-554.

Churchwell MD, **Mueller BA**. Pharmacokinetic Issues in Patients with Chronic Kidney Disease. *Blood Purif* 2007;25(1):133-8.

Mohammad RA, **Sweet BV**, **Mueller BA**, Perlman RL, **Stevenson JG**. Outcomes of erythropoietic growth factor interchange program in hospitalized chronic hemodialysis patients. *Hospital Pharmacy* 2007;42:119-125.

Klein KC, **Mueller BA**, Pearlman MD. Transplacental Passage of Vancomycin in Non-Infected Term Pregnant Women., *Obstet Gynecol* 2007;109:1105-10.

Decker BS, **Mueller BA**, Sowinski KM. Drug Dosing Considerations in Alternative Hemodialysis. *Advances in Chronic Kidney Disease* 2007 *Advances in Chronic Kidney Disease*, Vol 14, No 3 (July), 2007: ppe17-e26.

Churchwell MD, **Pasko DA**, **Btaiche IF**, Jain J, **Mueller BA**. Trace Element Removal during In vitro and In vivo Continuous Hemodialysis. Nephrology Dialysis Transplantation 2007.

Luan FL, Chopra P, **Park JM**, Norman SP, Cibrik DM, Ojo AK. Efficacy of valganciclovir in the treatment of cytomegalovirus disease in kidney and pancreas transplant recipients. Transplantation Proceedings 2006;38:3673-3675.

Hollis IB **Regal RE**. Calcium and Vitamin D in the Prevention and Treatment of Osteoporosis: Shedding Some Light on New Developments. Pharmacy and Therapeutics, May, 2007.

Regal RE. A capsule about cranberries: Can they stick for UTI prevention? Drug Store News 2007; 1: 29-34

Remington TL. Osteoarthritis Pain Management. Rx Consultant 2006;15:October issue.

Huston SA, Kirking DK, **Shimp LA**. Use, Intentions, and Beliefs about Hormone Replacement Therapy in Women With and Without Diabetes Maturitas 2006; 55(1 Aug 20): 58-68.

Stevenson JG, Mitchell JF. Alternatives to reduce the use of meperidine in hospital practice. Pharmacy Practice News April 2007.

Stumpf JL. Formulary Review: Deferasirox. Am J Health-Sys Pharm. 2007;64:606-16.

Stumpf JL. Novation Drug Monograph: Deferasirox. University HealthSystem Consortium. Oak Brook, IL. July 2006. (available online to UHC members)

Sweet BV. Natalizumab Update. UHC Monograph Series. 2006;17:1-23.

Tai MW, **Sweet BV**. Nattokinase: a promising agent for the prevention of thrombosis? Am J Health-Syst Pharm. 2006;63:1121-3.

Mohammad D, **Sweet BV**, Elnor SG. Retisert: is the new advance in the treatment of uveitis a good one? Ann Pharmacother. 2007;41:449-54.

Sweet BV. Natalizumab. Am J Health-Syst Pharm. 2007;64:705-16.

Sweet BV. Abatacept. Am J Health-Syst Pharm. 2006;63:2065-77.

Tamer, HR. Shehab, N. "Using preprinted medication order forms to improve the safety of investigational drug use." American Journal of Health-System Pharmacy. 63(11):1022, 1025-1026, 1028. 2006 Jun 1.

Brummett CM, **Wagner DS**. The Use of Alpha-2 Agonists in Peripheral Nerve Blocks: A Review of the History of Clonidine and a Look at a Possible Future for Dexmedetomidine. Seminars in Anesthesia, Perioperative Medicine and Pain. 2006; 25:77-83.

Wagner DS, Brummett C. Dexmedetomidine: As Safe as Safe Can Be. January 2006. Seminars in Anesthesia, Perioperative Medicine and Pain. 2006; 25:84-92.

Wagner DS, Yap JM, Bradley K. Assessing Parents Preferences for the Avoidance of Undesirable Anesthesia Outcomes in Their Children Undergoing Surgical Procedures. Pediatric Anesthesia, April 2007.

Tait AR, Burke C, Voepel-Lewis T, Chiravuri D, **Wagner D**, Malviya S. Glycopyrrolate does not Reduce the Incidence of Perioperative Adverse Events in Children with Upper Respiratory Tract Infections. Anesthesia Analgesia. 2006, 103(5):1-6.

Wagner DS, Gauger V, Chiravuri D, Faust K. Ondansetron Oral Disintegrating Tablets for the Prevention of Postoperative vomiting in Children Undergoing Strabismus Surgery. Therapeutic and Clinical Risk Management, November, 2006.

Caruthers R, Wagner DS, Local Anesthetics : A Review. Hospital Pharmacy, February 2007.

Letters to Editor

Alaniz C. Selection of sedative for mechanically ventilated patients. Crit Care Med. 2007;25:327.

Btaiche IF. Serum trace element concentrations in children with chronic renal failure. Pediatr Nephrol 2007;22:618-9.

Krein SL, Vijan S, **Choe HM**, Hayward RA. Quality improvement strategies for type 2 Diabetes. JAMA. 296(22):2680

Pangilinan JM, **Mitchell JF, Christen C**. Minimizing vincristine misadministration. Community Oncology. 2007;4(6):379.

Eschenauer G, **Regal R, DePestel DD**. Antibiotic Allergy. New England Journal of Medicine 2006;354:2293-2294.

Laiprasert J, **Klein K, Mueller BA**, Pearlman MD. Transplacental passage of vancomycin in non-infected term pregnant women. Obstet Gynecol 2007;109:1105-10.

Mohammad RA, **Klein K**. Inhaled amphotericin B for prophylaxis against invasive aspergillus infections. Ann Pharmacother 2006;40:2148-54.

Abstracts

Choe HM, Stevenson JG, Streetman DS, et al. The Impact of Patient Financial Incentives on Participation and Outcomes in a Statin Pill-splitting Program. 67th International Congress of FIP. April 2007, abstract 895

Washer LL, **DePestel DD**, Halm M, Rapa E, Newton D, Rivera-Starr C, Engleberg NC, Arndt J, Chenoweth, CE. Risk Factors for Extended-spectrum β -lactamase (ESBL)

Producing Escherichia coli and Klebsiella species in an Acute Care Hospital. [Abstract] 17th Annual Scientific Meeting of the Society for Healthcare Epidemiology of America (SHEA), 2007.

Washer LL, Swartz R, **DePestel DD**, Chenoweth CE. Catheter-Associated Bloodstream Infections in Patients Receiving Continuous Renal Replacement Therapy. [Abstract] 17th Annual Scientific Meeting of the Society for Healthcare Epidemiology of America (SHEA), 2007.

Stuntebeck ER, **DePestel DD**, **Collins CD**, Donovan B, Lamp KC. Retrospective Evaluation of Daptomycin, a Lipopeptide Antibiotic, in Bone Marrow Transplant and Hematology/Oncology Patients. Blood; American Society of Hematology (ASH) Annual Meeting Abstracts, 2006;108:Abstract 5531.

Bishop JR, **Ellingrod VL**, Moline J, Schultz SK, Clayton AH. The serotonin transporter promoter insertion/deletion in patients with depression and selective serotonin reuptake inhibitor (SSRI) associated sexual side-effects. Pharmacogenetics in Psychiatry Annual Meeting, New York, NY 2006.

Bishop JR, **Ellingrod VL**, Moline J, Miller D. The dopamine-2 receptor TaqAI polymorphism, prolactin elevation, and bone mineral density in persons with schizophrenia. College of Psychiatric and Neurologic Pharmacists (CPNP) Annual Meeting, Baltimore, MD 2006.

Ellingrod VL, Miller DD, Taylor F, Moline J, Holman T, Kerr J. Metabolic Syndrome and Insulin Resistance in Schizophrenia Patients Receiving Antipsychotics Genotyped for the Methylene tetrahydrofolate Reductase (MTHFR) 677CT Polymorphism. College of Psychiatric and Neurologic Pharmacists (CPNP) Annual Meeting, Colorado Spring, 2007.

Monahan A, Lum H, Gottimukkala V, **Carvey P**, **Frame D**. TNF- α increases transendothelial transport of methotrexate across human brain microvascular endothelial cells. Society of Neuroscience

Khalidi, N. "Infusion Phlebitis: Prevention through Simple Interventions – the Value of Midline Catheters" (Khalidi N, Btaiche I, O'Donnell, P). Proceedings of the Federation Internationale Pharmaceutique (FIP), Salvadore Bahia, Brazil, August 26-31, 2006

Khanderia, U. Medication adherence following coronary artery bypass graft surgery: Assessment of beliefs and attitudes" Circulation; May 29 2007, online edition www.ahajournals.org

Kraft MD, Julian F, Chung C, **Johnson CE**. Stability of metoprolol tartrate injection 1 mg/mL and 0.5 mg/mL in 0.9% sodium chloride and 5% dextrose injection. American Society of Health-System Pharmacists Midyear Clinical Meeting. Poster 157E. Anaheim, CA. December 2006. (poster)

Senagore AJ, **Kraft MD**, Du W, Fort JG, Techner L, Bell TJ. Alvimopan Is Associated With Reduced Overall and Prolonged Hospital Length of Stay in Patients Who Undergo Bowel Resection. Poster 206E. American Society of Health-System Pharmacists Midyear Clinical Meeting. Anaheim, CA. December 2006. (poster)

Enker WE, **Kraft MD**, Du W, Fort JG, Techner L. Reduction of Postoperative Ileus-Related Morbidity After Bowel Resection: Results of a Randomized, Placebo-Controlled, Double-Blind, Phase III Trial of Alvimopan 12 mg Versus Placebo. Poster 210E. American Society of Health-System Pharmacists Midyear Clinical Meeting. Anaheim, CA. December 2006. (poster)

Ludwig KA, **Kraft MD**, Du W, Fort JG, Techner L. GI Recovery Responder Analysis: Results of a Randomized, Placebo-Controlled, Double-Blind, Phase III Trial of Alvimopan 12 mg Versus Placebo in Patients Undergoing Bowel Resection. Poster 211E. American Society of Health-System Pharmacists Midyear Clinical Meeting. Anaheim, CA. December 2006. (poster)

Senagore AJ, **Kraft MD**, Du W, Fort JG, Techner L, Bell TJ. Alvimopan Is Associated With Reduced Hospital Length of Stay, Lowered Readmission Rates, and Decreased Costs After Bowel Resection: Pooled Data From 4 Clinical Trials. Poster 247E. American Society of Health-System Pharmacists Midyear Clinical Meeting. Anaheim, CA. December 2006. (poster)

VanLooy JW, Tran P, Schumacher RE, **Bhatt-Mehta, V**. Evaluation of Premedication Algorithm for Non-Emergent Intubation in a Neonatal Intensive Care Unit.

Lattimore K, Vazquez D, Barks J, **Bhatt-Mehta, V**. Developmental Outcome of VLBW infants treated with hydrocortisone for refractory hypotension.

Park JM, Luan FL. Incidence and risk factors of cytomegalovirus disease in adult kidney or simultaneous pancreas-kidney transplant recipients who received valganciclovir prophylaxis. American Journal of Transplantation 2006;6(s2):587.

Luan FL, Chopra P, **Park JM**, Norman SP, Cibrik DM, Ojo AK. Efficacy of valganciclovir for the treatment of primary cytomegalovirus infection in renal transplant recipients. American Journal of Transplantation 2006;6(s2): 585.

Patel MS, Englesbe MJ, **Park JM**, Harmon WE, McDiarmid SV, Magee JC. A cost-benefit analysis of screening, prophylaxis, and monitoring for Epstein-Barr virus to prevent post-transplant lymphoproliferative disorders across pediatric organ transplantation. American Journal of Transplantation 2006;6(s2):148.

Osta AD, Parekh V, **Regal RE**. Effect of early intern education (“intern boot camp”) and pharmacist intervention on the inappropriate use of proton pump inhibitors (ppi) and histamine (h2) blockers on the general medicine services. Department of Internal Medicine Research Symposium 2007. May, 2007. University of Michigan Health System Ann Arbor, MI.

Pham CQD, **Regal RE**, Bostwick TR, Knauf KS. Overuse of Acid Suppressive Agents on an Inpatient Internal Medicine Service. Canadian Pharmacist Association. Presented by CQD Pham. July, 2006

Tamer, HR. “Managing clinical research and the investigational drug service: Issues related to dispensing investigational drugs.” Continuing Education Platform Presentation. ASHP Midyear Clinical Meeting, Anaheim, California, December, 2006.

Walker PC, Flanders SA, Jones JT, Piersma J, Bernstein SJ, **Regal RR**. Pharmacist facilitated discharge: a prospective study of medication reconciliation and telephone follow-up interventions. American Society of Health-System Pharmacists Annual Meeting. San Francisco, CA, June 2007. To be published in the meeting proceedings and referenced in IPA.

Department of Clinical, Social and Administrative Sciences' Faculty were invited to present this past year a total of 63 international or national presentations, a total of 30 invited state presentations and a total of 46 invited local presentations.

DRUG INFORMATION AND INVESTIGATION DRUG SERVICES

Drug Information Service

The Drug Information Service provides pharmaceutical, pharmacological, and therapeutic information to the University of Michigan Hospitals and Health System and to health practitioners in the local area. In FY07, the Service handled over 3,000 questions for health care providers. In addition to providing drug information for patient care, the Service manages all drug shortages that require conversion to an alternative therapy or allocation of existing stock. Other responsibilities of the Drug Information Service include handling of product defects, drug recalls, review and approval of all requests for preprinted orders, and participation in the development of clinical guidelines as requested. In FY07, staff were very involved with implementation of the UM-CareLink physician order entry system, ensuring that formulary agents were appropriately entered into the system to accurately reflect restrictions on prescribing or use.



**Burgunda Sweet, Pharm.D.
Coordinator,
Drug Information Service**

The staff of the Drug Information Service support the functions of the **UMHHC Pharmacy and Therapeutics (P&T) Committee** and several of its subcommittees. In this capacity, they are responsible for conducting a thorough review of all published information related to safety and efficacy of new drugs, and to recommend the addition or deletion of products from the formulary, to recommend and implement therapeutic conversion programs, and to approve policies related to drug use. The P&T Committee is supported through several subcommittees including the Ambulatory Formulary Committee, Antimicrobial Subcommittee, Cancer Pharmacy Committee, Drug Use Evaluation Committee, Glycemic Management Subcommittee, Medication Safety Committee, and the Product and Vendor Selection Committee. Some of the key accomplishments of the Committee in FY07, either directly or through the subcommittees, include:

- Reviewed 44 new pharmaceutical agents and over 150 medication line item extensions
- Implemented and/or modified restriction criteria for several agents due to safety concerns
- Worked with the Orders Management Project for clinical and policy-related decisions in the development of CPOE
- Implemented therapeutic interchange program making ondansetron the preferred serotonin antagonist on formulary
- Developed and posted several new policies to ensure safe use of medications
- Developed and posted preprinted order sets for several disease states, and for chemotherapy and investigational drug protocols to improve medication safety
- Revised antiemetic guidelines for chemotherapy and post-operative nausea and vomiting
- Developed and implemented a web-based continuing education program as an educational tool for pharmacists on formulary decisions

The **Ambulatory Formulary Committee** is a multidisciplinary group with representation from several physician leaders, pharmacy services, Blue Care Network, and the pharmacy benefits program. The goal of this committee is to determine an educational drug list for preferred agents that provide good clinical care at reasonable costs. Academic detailing of pharmacy-specific information is used to help direct ambulatory prescribing to the preferred agents. Active switch programs are also run through this group to more effectively shift ambulatory prescribing to preferred generic alternatives.

Accomplishments of this group in FY07 include:

- Developed and implemented a centralized voucher distribution program run through pharmacy services. Sixty-nine vouchers were submitted for consideration, with only a handful of these approved by the committee for distribution within the UMHHC facilities.
- Implemented active conversion programs for statins (to generic simvastatin) and proton pump inhibitors (to generic ondansetron)
- Distributed 13 targeted email communications (FGP-Grams) to medical staff about timely drug-related topics
- Endorsed the Michigan Community Health Initiative, a 2-year pilot program focusing on diabetes management that is run through the University Pharmacy Benefit Program
- Implemented a voluntary pill-splitting program for the statins
- Approved a policy for Physician Prescribing for Family and Friends
- Approved the development of a formulary for ambulatory care clinics

Health care staff are kept informed of Pharmacy and Therapeutics Committee decisions and new information regarding medications by means of the monthly, web-based **Pharmacy ForUM Newsletter**. In addition to announcing formulary changes, each monthly issue includes current news briefs and several articles of interest related to drug therapy or safe use of medications. The table of contents is sent to all UMHHC health-care providers by email, with a link to the full online newsletter.

Committees

| Committee | Responsibilities |
|--|--|
| Pharmacy and Therapeutics Committee | Charged with ensuring safe and effective drug use within the institution. Its activities are supported by several subcommittees |
| Ambulatory Formulary Committee | Charged with developing an ambulatory formulary and impacting physician prescribing in the ambulatory environment to reduce ambulatory pharmaceutical expenditures while maintaining optimal clinical care |
| Antimicrobial Subcommittee | Advises P&T Committee on issues related to antimicrobials |
| Cancer Pharmacy Committee | Advises P&T on issues related to cancer therapy |
| Drug Use Evaluation Committee | Reviews drug use within the institution in order to ensure compliance with criteria, and improve |

| | |
|---|---|
| | medication safety and fiscal accountability |
| Glycemic Management Subcommittee | Reviews medications and treatment protocols designed to improve and standardize glycemic control processes |
| MedSafe Committee | Reviews the medication use process to improve medication safety |
| Product and Vendor Selection Committee | Reviews market changes in formulary products (new formulations, generics or pricing) to continually enhance formulary effectiveness |

INVESTIGATIONAL DRUG SERVICES

The Investigational Drug Service (IDS) is a medical-school-mandated service for research protocols involving human subjects that involve the use of medications not yet approved by the FDA. In addition, the Service handles multiple other protocols involving commercially available drug. The goal of the IDS is to ensure that investigational drug studies and other drug-related research at the UMHHC are conducted in compliance with the requirements of the FDA, study sponsors, Michigan State Board of Pharmacy Regulations, and JCAHO. The IDS handled over 275 active drug protocols in FY07, with approximately 55% being done in oncology, and the balance in non-oncology studies. IDS staff works with investigators to improve study design and ensure feasibility of the study, establish randomization procedures, prepare/dispense study drug, and monitor progress of the study through completion.



Major accomplishments for FY07 include full implementation of WebIDS computer system for all protocols, relocation into a newly renovated dispensing and office space, and implementation of carousel technology for inventory storage and maintenance. Significant staffing changes include recruitment and hiring of the newly defined IDS Coordinator and an increase of 1 FTE technician and 0.6 FTE pharmacist positions to accommodate the growth in oncology studies. In addition, the IDS reporting lines have been revised to provide direct reporting to the Associate Director to better facilitate better integration of IDS activities within the department.



This year, IDS was audited by 3 cooperative groups, and passed all with no citations. IDS pharmacists have increased their participation in research oversight activities to include two appointments to IRBMED (as regular voting member and Vice-Chair of Board C1, and as regular voting member on Boards A2 and B1), appointment to the Protocol Review Committee (PRC), and representation to the General Clinical Research Center (GCRC). Finally, the pharmacists continued their support of the teaching mission of the health system through

preceptorship of pharmacy students and provision of a number of education programs for the Clinical Trials Office.

COMPUTERIZATION AND AUTOMATION

The Department of Pharmacy utilizes and supports computer and automated systems in a number of areas. The Medical Center Information Technology (MCIT) Pharmacy team is responsible for supporting a number of these systems. The department has also utilized its own technical expertise in developing and supporting systems such as PharmDoc, WebIDS and the Pharmacy external and internal web pages.

MCIT Pharmacy team

The MCIT Pharmacy team is a group within MCIT assigned solely to the support of technology in Pharmacy. This includes support of major pharmacy applications, Pharmacy automated dispensing systems, and other technical responsibilities such as ad hoc report production and desktop support. The team is located in the B2 Pharmacy administrative office area. The group provides Pharmacy systems support 24 hours per day, 7 days per week, 365 days per year. The team responds to an average of 90 MCIT help desk calls per month.



In addition to implementation and support activities, the MCIT Pharmacy team is actively involved in the education of pharmacy informatics professionals through the PGY2 Pharmacy Informatics program and precepting students on rotation from the College of Pharmacy.

Major Pharmacy systems

- WORx – Inpatient Pharmacy system used to support Pharmacy dispensing, clinical and billing activities.
- QS/1 – Outpatient Pharmacy System used to support pharmacy dispensing, clinical and billing activities in the East Ann Arbor, Ambulatory Care and CGC outpatient pharmacies.
- QS/1 – Outpatient Pharmacy Point of Sale system used in all outpatient pharmacies
- Ateb IVR phone refill system used in the Ambulatory Care Pharmacy
- Omnicell – Approximately 100 automated dispensing cabinets utilized throughout the Medical Center inpatient and outpatient locations.
- SecureMed – Narcotic Vault management system
- ECHO – Amerisource/Bergen purchasing system
- PharmDoc.Net – Clinical pharmacy management system
- WebIDS – Investigational Drug Service management system

Pharmacy automated dispensing systems

- **Omniceil** – dispensing system used to secure and manage medication inventory



- **McKesson RxOBOT**
 - UH inpatients only
 - Fills on average 450 drawers/day
 - 4000 - 4500 pics/day
 - 798 line items



- **ScriptPro**

- Used in Ambulatory Care Pharmacy (ACP)
- Fills approximately 40-45% of ACP prescriptions
- Contains 178 Line items



Fiscal Year 2007 Activities

There was a great deal of activity in computerization and automation in the Department over the past year. This work included the following projects:

- **WORx in patient Pharmacy system**
 - Supported implementation of The UMCareLink order entry system with and orders interface to the WORx system.
- **QS/1, outpatient pharmacy system**
 - Performed QS/1 Version 18.1.18 Upgrade
 - Performed ATEB IVR Server/Computer Hardware Upgrade
 - Performed QS/1 QS/1 Server Hardware Upgrade
 - Performed QS/1 Version 18.1.20 Upgrade
- **Omnicell Pharmacy Central (OPC) Inventory system**
Supported system implementation in May of 2006
- **ECHO**
 - Performed ECHO Version 4.2 Upgrade Implementation
 - Performed ECHO Controlled Substance Ordering System “Cyclone” Pilot
- **Hospira MedNet Wireless PCA pump project**
Performed an upgrade to version 4.1 of the MedNet Wireless PCA Pump application.
- **Omnicell:**
 - Deployed 22 cabinets to CVC (8 redeployed from UH CathLab and 14 new cabinets).
 - Upgraded server and all cabinets to Omnicell 11000 version of software.
 - Installed Safety Stock hardware on all cabinets.
 - Beta site for Omnicell 11.0 and 11.5 Beta programs.
 - Upgraded all cabinets to 11K software.
 - Installed new cabinets in: 1OBS, TBICU, CGCINF2, CGC B2 Proc, PCTU Exp, Rad Annex, Mott OR Core, B2 Night Vault, B2 IV Rm, ER B1C111

Key Automation projects planned for FY 2008

Computerization and automation efforts in the Department of Pharmacy continue this year with the following active major projects:

- UMCareLink Project implementation in University Hospital
- WORx, inpatient Pharmacy system, upgrade to version 2.9.5
- Omnicell system Beta partner
- Development and implementation of new PharmWeb 2.0 information portal for Pharmacy
- Implementation of a new RFID based Drug kit tracking system
- Implementation of a new web application to allow on-line ordering of pharmaceuticals by clinics

CONTINUOUS QUALITY IMPROVEMENT

Quality Improvement and Regulatory Compliance Committee

The Department of Pharmacy Services Continuous Quality Improvement Program revolves around the departmental mission: excellence in patient care, education, and research. The committee's specific charge is to ensure the continuous competency of all staff as they perform their care for patients, and a complete compliance of practices and processes with all the safety and regulatory rules and regulations set by regulatory agencies and professional organizations. It is composed of a chair, in medication safety coordinator, manager of ambulatory care, and leads in regulatory compliance and clinical services, staff competency, inpatient decentralized services, and system and technology improvement. The group is led by a senior pharmacy manager.



**John Clark, Pharm.D., M.S.
Associate Director of Pharmacy**

Primary Activities of the Quality Improvement and Regulatory Compliance Committee

Staff Competency

- Conducted an annual educational competency program in March. Compliance with this competency testing this past year has been at 100%.
- Utilized M- Learning, the computerized administration, correction, collation, and reporting this data to respective staff members, and provided aggregate data to both the department and the institution.
- Replaced the bacterial surveillance program for intravenous product with the media fill testing for all designated staff as required by USP 797 on Pharmaceutical Compounding – Sterile Preparations.

Regulatory Activities

- Extensive planning took place to meet Joint Commission requirements for compliance with the medication management standards and the medication-related National Patient Safety Goals (for 2006 and 2007).
- Provisional accreditation was issued from ASHP for our specialty residencies in Infectious Diseases, Oncology, Informatics, Critical Care, and Pediatrics.
- Centers for Medicare and Medicaid Services (CMS) made a visit to follow-up with concerns raised during a JCAHO validation survey conducted in February 2006. A corrective action plan was submitted and awaits final approval by CMS. Four other CMS visits in FY 2006 were related to unsubstantiated patient complaints. Issues raised with the pharmacy were related to dating of multi-dose medication vials, and corrective action has taken place, including revision of our multi-dose product and vial policy.

Additional Tasks:

- Departmental QI plan updated (annually)
- Planning and implementation of the patient reconciliation process compliant with the patient safety goals
- Participation in hospital-wide surveys and audits of medication storage areas
- Conducted of Periodic inpatient and outpatient pharmacies surveys and audits
- E-mail communications to staff and management on compliance issues
- Preparation and dissemination of reports as requested
- Policy and procedures review and coordination – four policies and procedures were revised: Multi-Dose Vials and Products (PP 158.00), Controlled Substances (130.00), Medications at the Bedside (PP 135.00), and Dress and Appearance Code (PP 114.90).
New policies drafted and implemented include:
 - College of Pharmacy Faculty Practicing Within UMHHC (PP 113.00)
 - Single Dose Vial Medications (PP 158.01)
 - Multiple Dose Medications (PP 190.00)
 - Access to Medication Rooms and Storage Areas (PP 180.00)
 - Medication Reconciliation (UMHHC Policy 07-01-002)
 - A General Pharmacy Operations Policy section was created in the pharmacy policy website, which includes policies applicable to both inpatient and outpatient pharmacy operations, which should improve ability of staff to locate a policy on the website.
 - A Medication Policy section was added to the UMHHC policy website to aggregate all medication-related policies together on the policy website, which should improve ability of staff to locate a policy on the website. Medication policies were renumbered in section 07, with links to former policy numbers.
- The structure of the QI and regulatory committee was revised to add a decentral pharmacy supervisor.
- The expiring medication function was activated in omnicell to ensure medications were within their stated expiration dating.
- The Ambulatory Care Pharmacy implemented a coaster paging system in response to patient concerns they were waiting too long for their prescriptions.

Proposed Goals for FY08

- The following is a list of proposed activities for FY08
 - Omnicell System:
 - Rate and reasons for overrides
 - Controlled substances discrepancies within pharmacy
 - Employee turn over and reasons
 - Medication errors trending and clinical alerts and follow-up as documented in PharmDoc
 - Chemotherapy double checks and accuracy will continue to be measured and remains stable
 - Inspection rate of medication storage areas in Omnicells and outpatient clinics will continue to be measured
 - Ensure compliance with USP 797 requirements with current version and after revision is published.
 - Assist in opening of IV Clean Room to ensure all regulatory requirements are considered

- Participate in implementation of PACMED to ensure compliance with regulatory compliance.
- Engage in the implementation of Verify use in the preparation of IV therapies, so all components are identified positively by bar code scanning prior to preparation of the medication. This will improve the safety of our patients.

PURCHASING

The Department of Pharmacy Services provides direction and oversight of the pharmaceutical purchasing activities for the Health System.

These activities include:

- Coordination of the pharmaceutical and prime vendor bid process
- Management of the PHS 340b Drug Purchasing Program
- Monitoring purchases for contract compliance and correct billing
- Identification of potential purchasing cost reduction opportunities
- Troubleshooting identified product shortages



In FY 2007, the Department of Pharmacy Services experienced a 4% increase in total pharmaceutical purchases compared to FY 2006. Inpatient purchases remained relatively equal to FY2006 spending levels, and the resulting increase was primarily attributed to purchases made in the ambulatory/clinic areas.

Pharmaceutical purchases for the year totaled approximately \$81,000,000. \$37,000,000 of product was purchased by the hospitals and affiliated clinics and \$44,000,000 was procured to support our ambulatory pharmacy and infusion operations. Total purchase activity spanned 2500 line items and was transacted utilizing University and Federal Public Health Service (PHS) contracts that were administered by a pharmaceutical prime vendor supplier.

Ongoing purchasing challenges experienced in FY 2007 included:

- Brand product price increases in excess of CPI
- Negotiation of specialty distribution contracts for new and current products
- Ongoing product shortages

Significant cost saving initiatives implemented in FY 2007:

- Continued conversion to various generic products in the inpatient and outpatient setting due to patent expirations
- New pharmaceutical bid awards realizing lower pricing on multi –source injectable products. (Ondansetron – most significant impact in FY 2007)
- Continued success in the negotiation of “inpatient PHS pricing” from various pharmaceutical manufacturers for product used in the inpatient areas.
- Inpatient therapeutic interchange initiatives (OR neuromuscular blockers- most significant impact in FY 2007)

BUSINESS OPERATIONS

Budget performance

Pharmacy services had total gross revenue of \$296 million in FY07, and \$100 million in expenses.

- The inpatient and OR areas combined had \$52 million expenses, up 3% over the prior year. This growth was driven by increased hospital volume and staff costs.
- UMH qualified in January 2004 as a Disproportionate Share Hospital for 340b discounts, which reduce outpatient drugs costs by up to 30%.
- The Retail Pharmacy area, experienced a 5% increase in the number of prescriptions filled, but also had a change to more expensive prescriptions on average.
- The Infusion area continued its trend of significant volume increases, for a 16% increase in revenue



Alice Schuman
Administrative Manager

UMH Pharmacy Services FY07 Revenue and Expenses

| | Inpatient & OR | Retail | Infusion | Total |
|--|-------------------------------|---------------|-----------------|---------------|
| FY07, July 2006 - June 2007 (in 000s) | | | | |
| Revenue | 170,341 | 23,899 | 101,556 | 295,795 |
| Salary/Benefits | 15,539 | 1,962 | 1,907 | 19,409 |
| Supplies/other | <u>36,443</u> | <u>15,615</u> | <u>28,851</u> | <u>80,909</u> |
| Total exp | 51,981 | 17,577 | 30,759 | 100,318 |
| <i>Gross margin %</i> | <i>69%</i> | <i>26%</i> | <i>70%</i> | <i>66%</i> |
| Percent Change from Previous Year | | | | |
| Revenue | 10% | 12% | 16% | 13% |
| Salary/Benefits | 11% | 3% | 20% | 11% |
| Supplies/other | <u>0%</u> | <u>15%</u> | <u>6%</u> | <u>5%</u> |
| Total exp | 3% | 13% | 7% | 6% |

Statistical Information

The Department of Pharmacy monitors several key performance ratios.

- Inpatient drug costs per patient day have risen on average 5%/yr the past five years.
- Inpatient personnel costs have risen by an average of 10%/year per patient day over the past five years to address additional medication complexity and patient safety issues.

- Retail area personnel costs have risen by an average of 4%/year per prescription over the past five years, driven by an increase in the ratio of new-to-refill prescriptions and more time spent processing discharge prescriptions.
- Infusion area personnel costs per infusion have risen on average 14%/yr over the past five years to address additional medication complexity and patient safety issues.

Staffing Levels

Department of Pharmacy staffing levels have been increased over the past three years to address issues of increased volume and complexity and to better address patient safety issues. The growth over the past five years has been mostly in pharmacists, both staff and clinical. This segment of the staff has grown 9%/year over five years, compared to the pharmacy technician growth of 6%/year over that same time period.

UMH Pharmacy Services Staffing Levels, One Year and Five Year Average Trend

| | FY02 | FY03 | FY04 | FY05 | FY06 | FY07 | 1 year change | Avg Yrly Change |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|---------------|-----------------|
| Pharmacists | 69 | 69 | 70 | 84 | 88 | 98 | 11% | 9% |
| Technicians | 91 | 90 | 92 | 100 | 107 | 120 | 12% | 6% |
| Residents | 5 | 8 | 8 | 7 | 8 | 9 | 13% | 16% |
| Management | 13 | 14 | 13 | 14 | 15 | 14 | -10% | 2% |
| Office | <u>14</u> | <u>12</u> | <u>11</u> | <u>10</u> | <u>10</u> | <u>10</u> | <u>0%</u> | <u>-6%</u> |
| Total | 191 | 193 | 192 | 215 | 228 | 251 | 10% | 6% |

HOMEMED

HomeMed operates as a business unit where commodity procurement, receiving, insurance verification, claims processing and cash application operation activities are all completed within the pharmacy located at 2850 S. Industrial Hwy., which is approximately 2 miles south of the main medical campus. A positive net margin is consistently generated in the area and this contributes to the health system margin target and support of non-revenue generating activities. Clinically, patient care, quality and process improvement programs are integrated into the health systems institutional plan and contribute to maintaining the institution's tradition of leadership in healthcare.



**Christopher Maksym, Pharm.D.
Director, HCS**

Service Description and Background

HomeMed is a licensed pharmacy and home infusion provider responsible for providing a wide range of products and services to safely and effectively facilitate care to UMHS patients in the convenience and comfort of their home. Since 1989, HomeMed has been providing infusion medications, nutritional therapy, specialty drugs, high-tech infusion nursing and care management services throughout Michigan and Northern Ohio. An interdisciplinary team consisting of pharmacists, nurses and dietitians along with technical, administrative and support staff totaling 105 FTEs provide pharmacy compounding, equipment management, dispensing, delivery and care management services to ensure that patient home regimens are safe and effective throughout the course of therapy. Staff have direct access to up-to-date and complete medical and patient drug information which facilitates effective and efficient collaboration with physicians and other caregivers within the health system. In order to ensure a smooth transition to home care, HomeMed has a hospital-based training and education team; this team consists of nurses and dietitians who work with patients and the referring health care team to ensure that home care needs are identified prior to hospital discharge and infusion nurses who provide care for the patient in the home.

Although HomeMed resides within the Home Care Service division in the Hospital and Health Centers corporate structure an administrative relationship exists between HomeMed and the Department of Pharmacy Services. Thus many administrative, pharmacy practice and educational activities are collaborative and integrated. There is HomeMed representation on several Department of Pharmacy and Health System committees. Additionally, most HomeMed clinicians and leaders hold academic appointments within the University reflecting the commitment to teaching, experiential training and research.

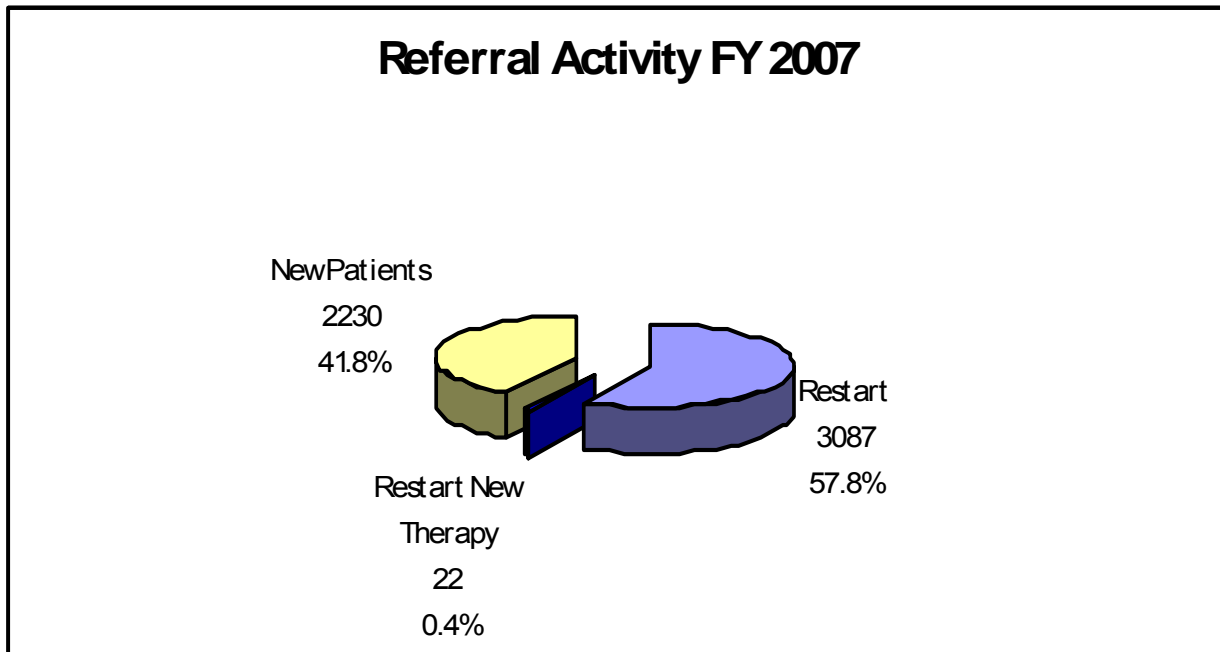
2007 Year in Review

Referral Activity

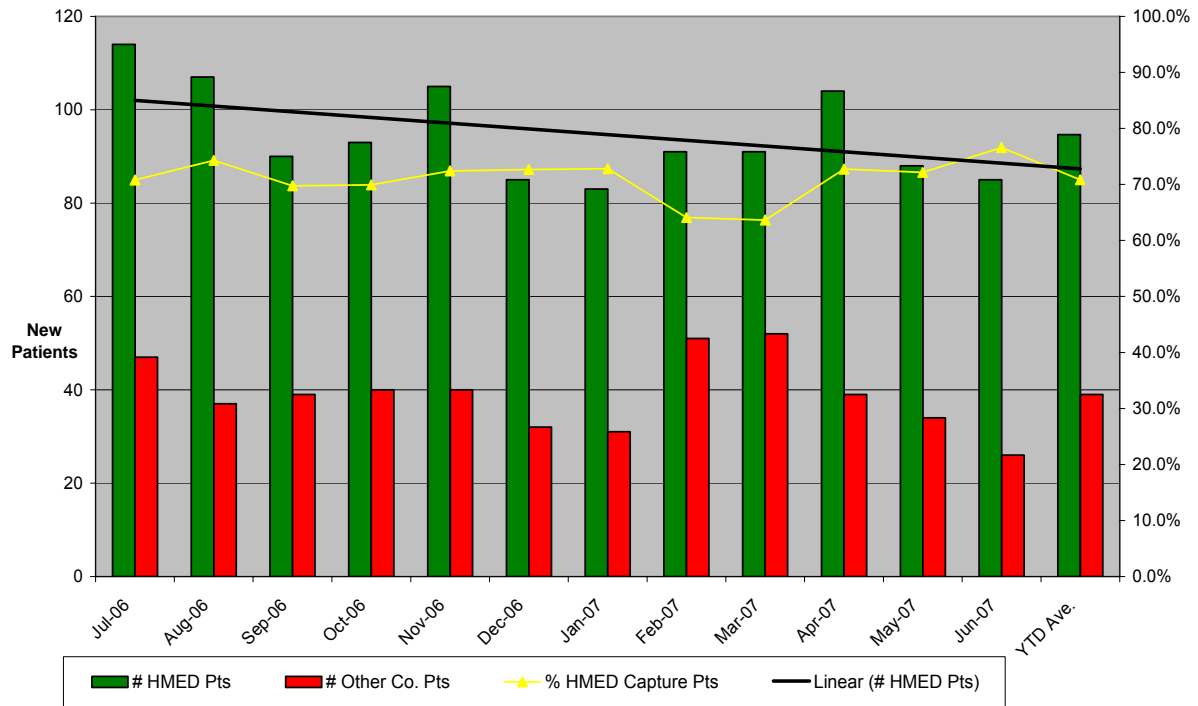
An average census of 1,296 patients was maintained by processing 2,230 (41.6%) new patient therapy referrals and 3109 (58.4%) existing patient therapy or existing patient new therapy referrals. HomeMed referrals are obtained exclusively from UMHS where on average 70.8% of patient referrals (an average 70.4% of therapies) processed by Discharge Planning were referred to HomeMed opposed to other home infusion providers.

The majority (60.9%) of home infusion therapy referrals originate from inpatient hospital discharges. Thirty-five (35.7%) percent of HomeMed referrals come from ambulatory care areas with the Cancer Center being the predominant origin of referrals in this category. The remaining three (3.4%) percent of referrals originate in either the emergency department, primary care sites or in the home where typically a previous patient is restarted on a therapy previously administered in the home.

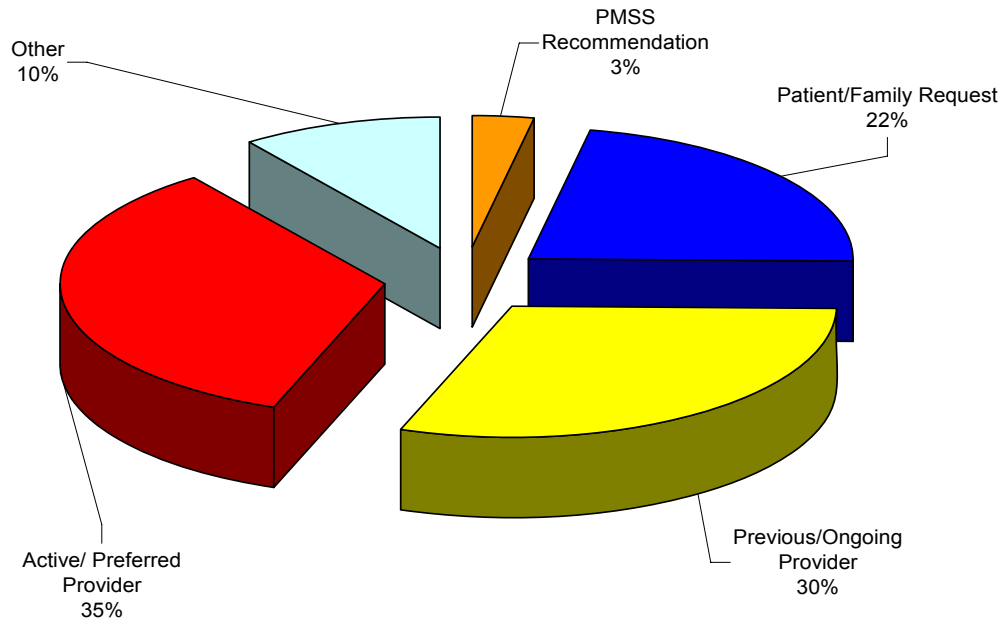
Of patients not referred to HomeMed, the majority (65%) were not serviced by HomeMed due to previous provider relationships and preferred provider payer agreements as assessed by the discharge planning clinician.



HomeMed Referral Capture Tracking FY '07 New Patients and Capture Rate



FY 2007 HomeMed Referral Non Use Summary
(N = 516)



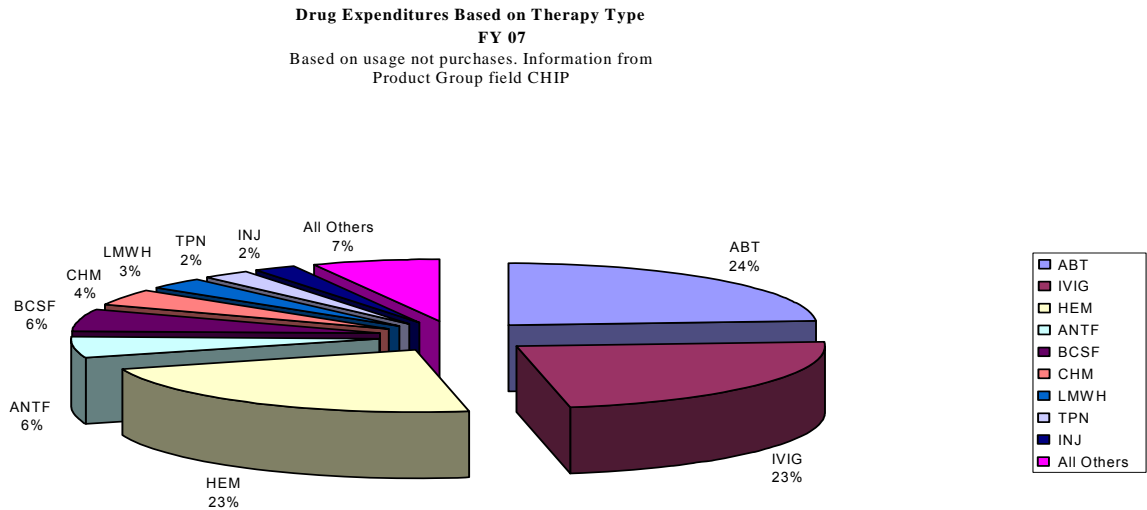
Pharmacy Operation Activity

Selected metrics are presented in the table below and illustrates an increase in activity and this correlates with the increase, albeit slight, in revenue realized.

| | FY '07 Total | Monthly Average FY '07 | FY '07 % Change - Vs- FY '06 |
|-----------------------------------|--------------|---------------------------|---------------------------------|
| Total Orders Processed | 27,108 | 2464 | 9.9% |
| Total Prescriptions Filled | 43,351 | 3941 | 8.2% |
| Total Units Admixed by Therapy | 95,163 | 8651 | 16.5% |
| New Therapy Starts | 4855 | 441 | 23.7% |
| Total Infusion Days | 319,435 | 29,040 | 10.4% |
| HomeMed Deliveries | 13,932 | 1267 | 9.7% |
| Sub Contracted-HomeMed Deliveries | 8,299 | 754 | -10.7% |
| Total Deliveries | 22,231 | 2021 | 1.0% |
| Percent HomeMed Deliveries | 62.7 | | |

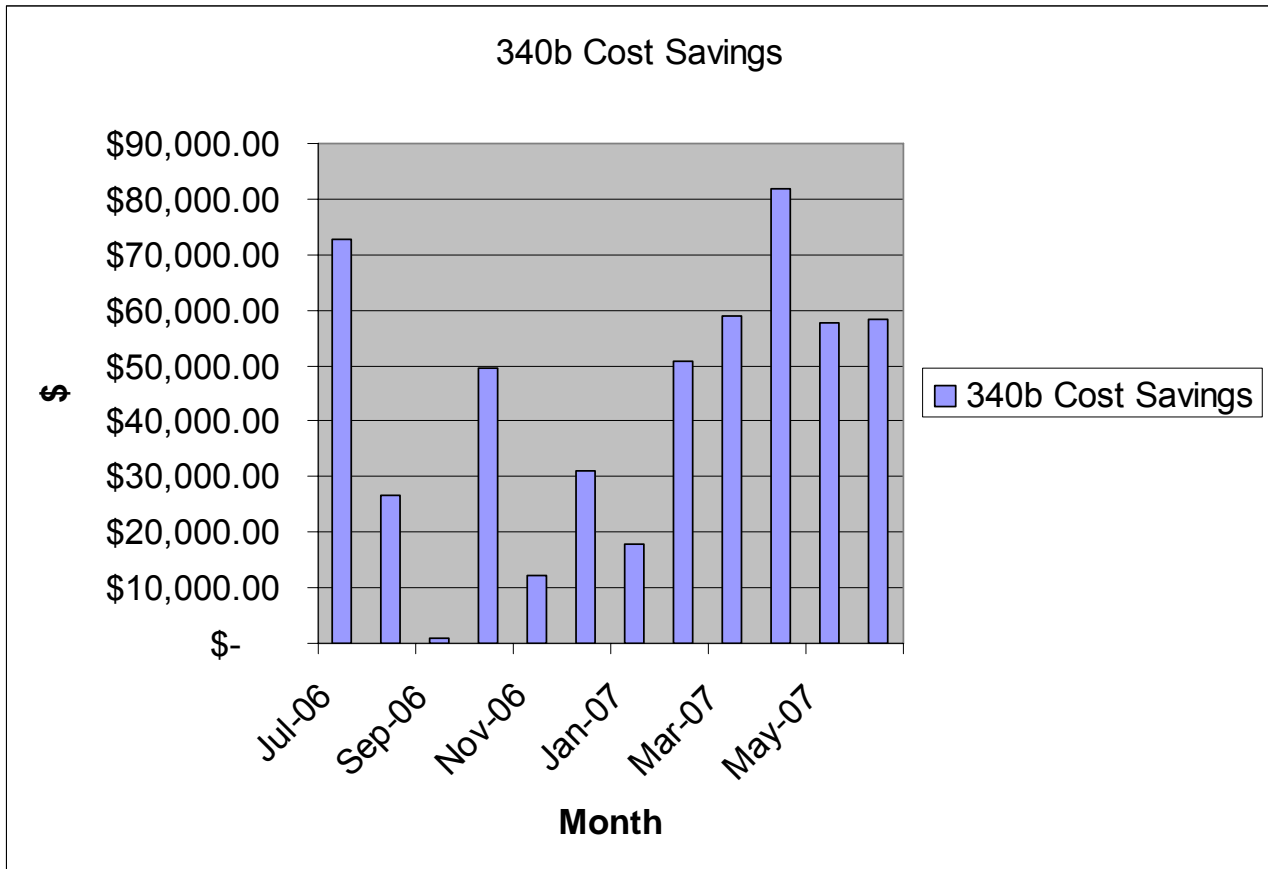
Drug Spend and Inventory Management

The HomeMed drug spend was \$5.8 million (a 7.98% decrease from FY 06) and this represented approximately 33.2% of the total operating expense. Five therapies (i.e., antibiotics, intravenous immunoglobulin, anti-hemophilia factor, anti-fungal agents and blood component stimulating factors) comprise 82% of the annual drug expense as illustrated below.

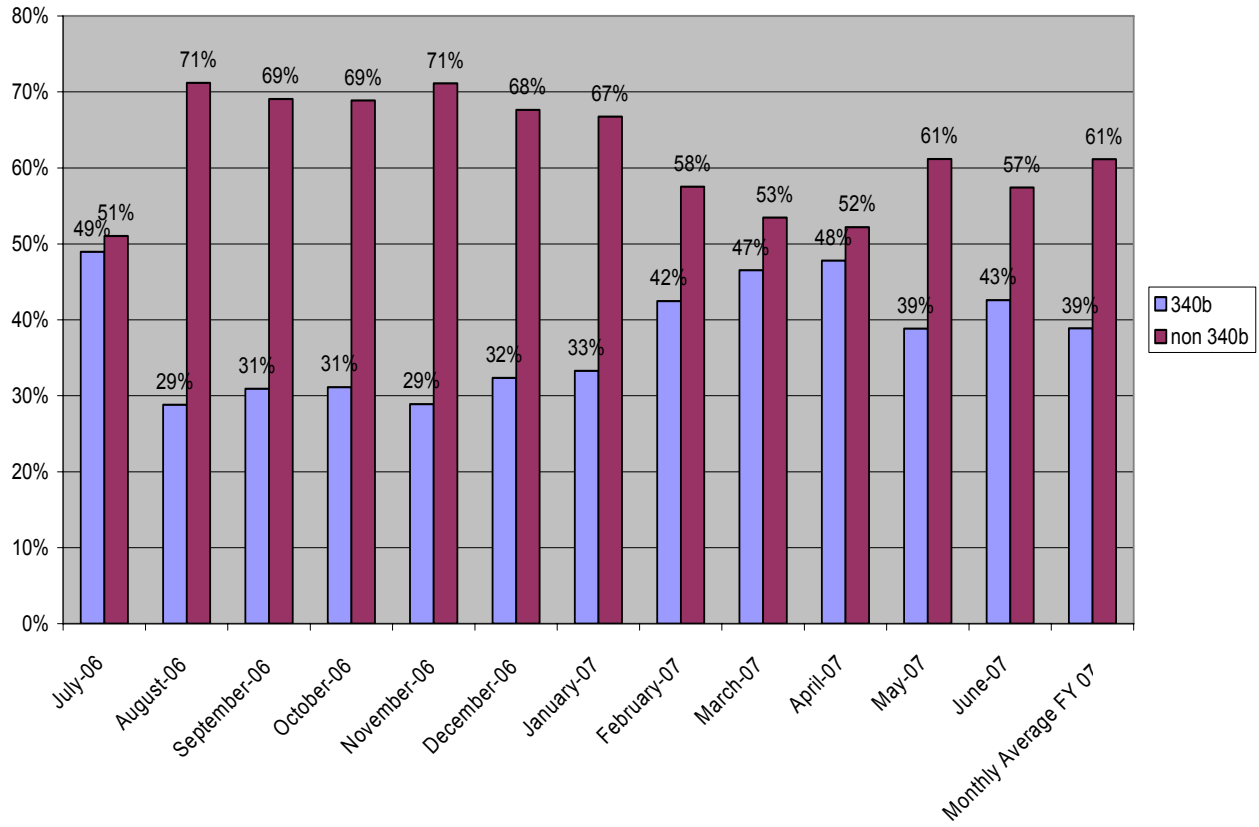


340B Drug Purchasing Program

HomeMed realized a cost savings of \$534,883 through purchasing pharmaceuticals (exclusive to Hemophilia product) at 340B pricing; an additional \$300,000 (estimated based on an average of 20% savings) in savings was achieved through purchasing Hemophilia products. In total, over \$800,000 in yearly cost savings was evidenced. 340B purchases and percentages are based on drug spend for the year. Depicted graphically are 340B drug purchases based on spend amount and as a percentage based on cost. With the exception of approximately \$250,000 dollars attributed to inaccessibility to 340B prices for Gamunex, HomeMed maximized its use of 340B purchase opportunities based on eligibility. Additionally, HomeMed will access non 340B UMHC contract pricing for pharmaceutical purchases in instances where 340B pricing is higher.

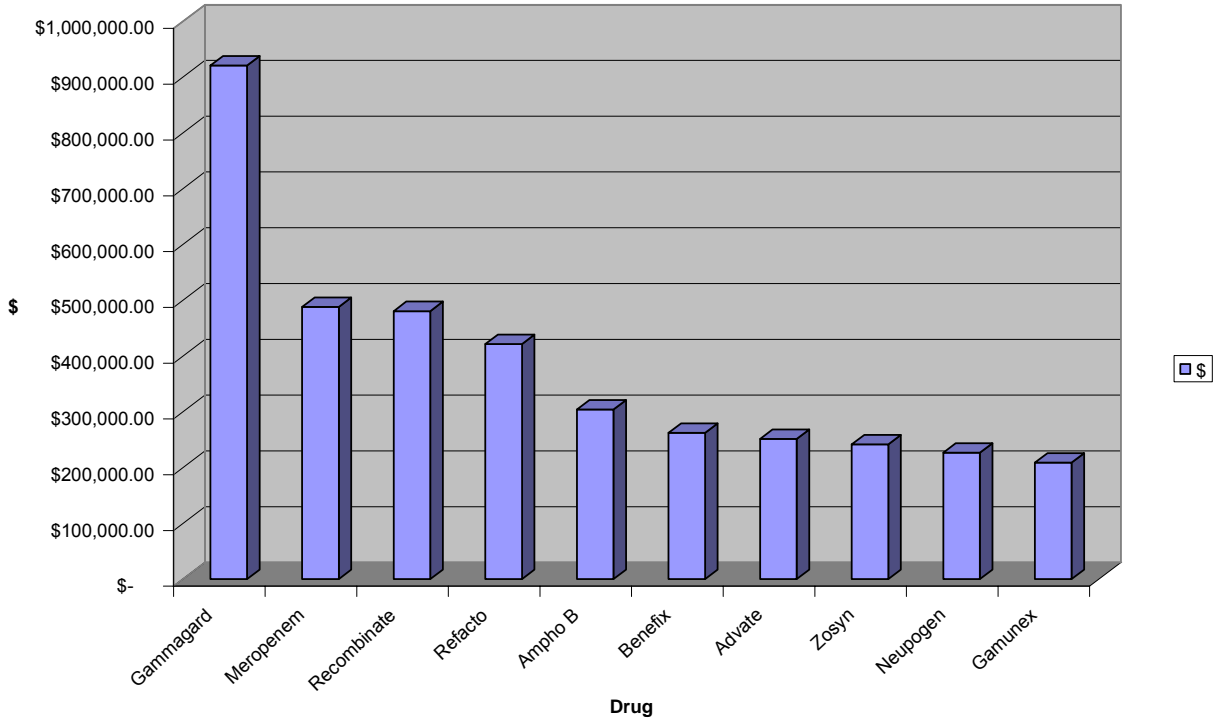


340b/Non 340b % - Monthly
FY 07



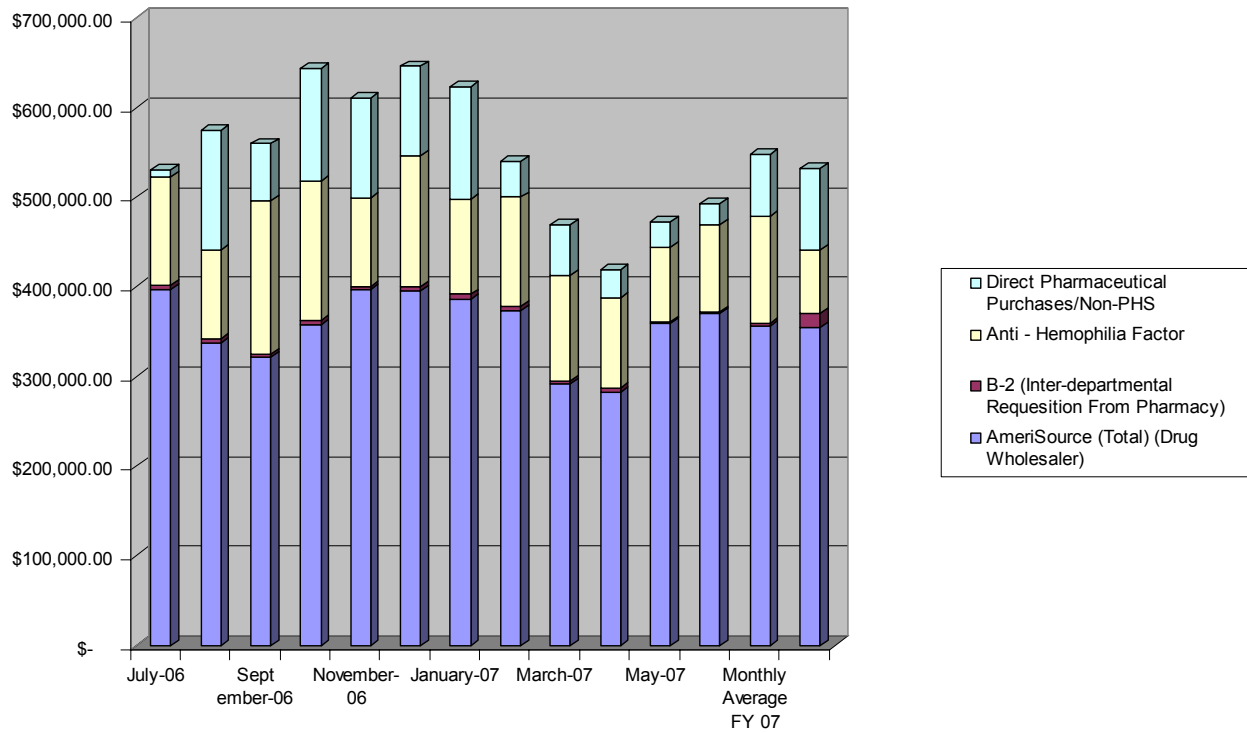
Ten pharmaceuticals comprise 64.6% of the total drug spend as illustrated graphically.

**HomeMed Top Ten Drug Usage by \$
FY 2007**



HomeMed purchases the majority (89.6%) of its pharmaceuticals from the institution's primary drug wholesale company, AmerisourceBergen. A very small amount (1%) is procured from the department of pharmacy with the remaining drugs obtained directly from the manufacturer or secondary wholesaler (primarily biologics on backorder).

FY 07 Monthly Pharmaceutical Purchases

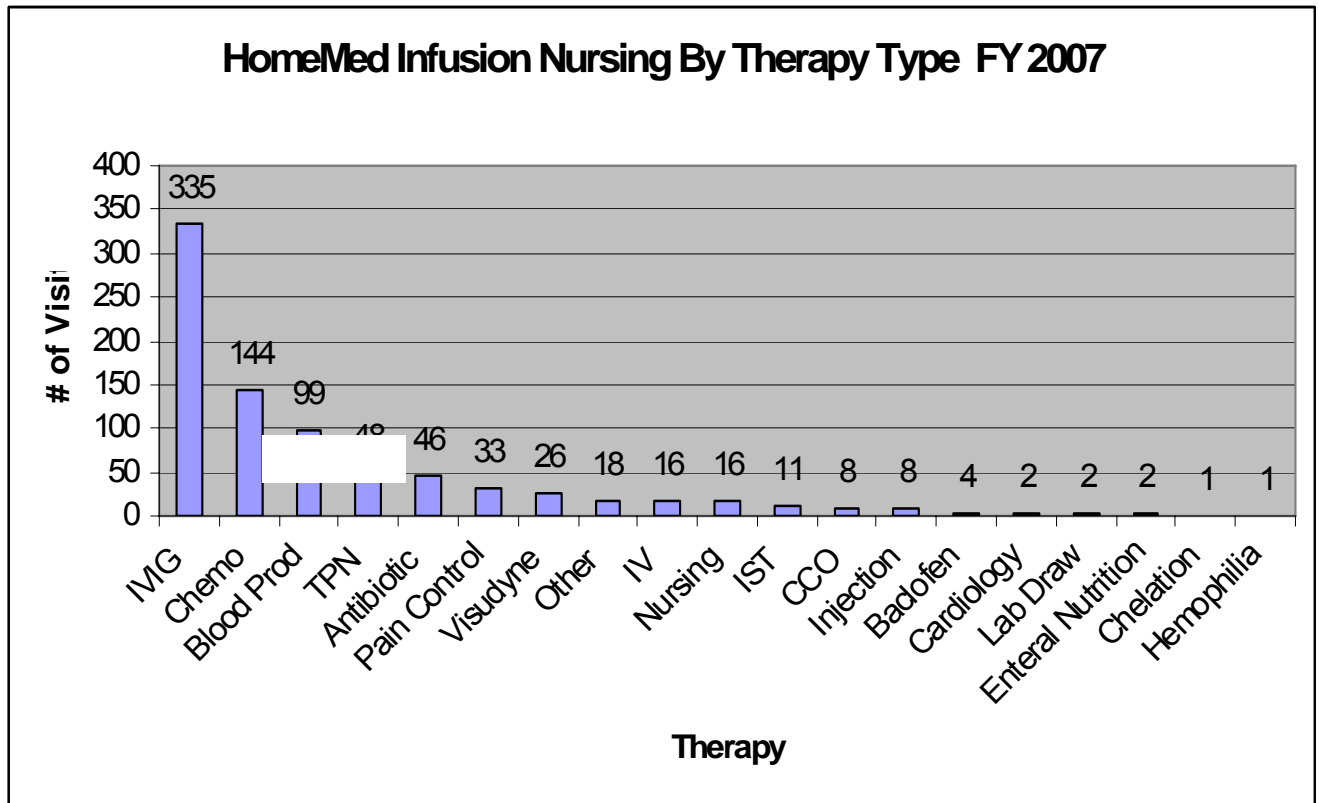


The annual physical inventory was completed on June 9, 2007 and revealed an inventory value of \$713,471. This computes to an annual inventory turn rate of 10.41 turns which is lower than desired and balanced with ongoing problems with product outages and back orders at both the wholesaler and manufacturer levels.

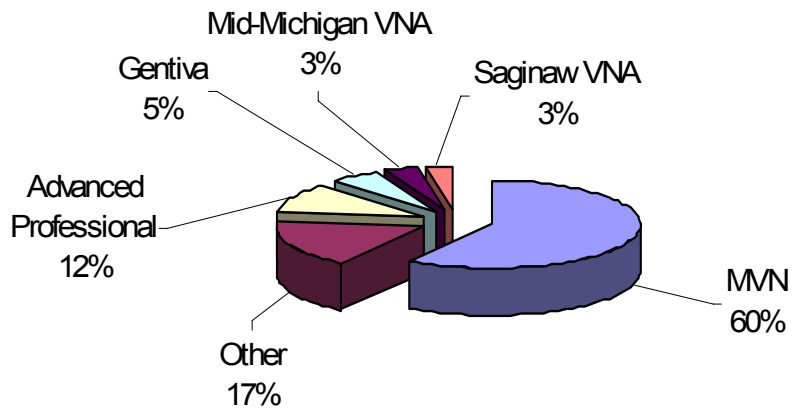
Home Infusion Nursing Activity

A total of 4,336 in-home infusion nursing visits were made by a combination of HomeMed infusion nurses (18.9% or 821) and subcontracted nursing agencies (81.1% or 3,515) to fulfill payor-contract requirements. HomeMed infusion nursing activity is typically associated with more complex visits (e.g., IVIG administration, Synchromed Pump refills, and chemotherapy) and visits where other agencies do not have available nurses to provide services at the time needed.

Note that these totals do not include other agency visits which were not sub-contracted wherein the home health agency billed the payor directly. Michigan Visiting Nurses (Michigan Health Corporation) is the predominant provider of in home nursing services to HomeMed patients as illustrated in the following chart.



HomeMed Subcontracted Nursing Activity FY 2007



■ MMN ■ Other □ Advanced Professional □ Gentiva ■ Mid-Michigan VNA ■ Saginaw VNA

Selected Accomplishments

- Full implementation of a pharmacy technician career ladder beginning with an entry level followed by two levels of advancement
- Initiation of two LEAN Groups to address Pharmacy Assessment and Patient Education and Training
- Process change to accommodate direct per diem billing of nursing services to BCBSM
- Software conversion from TPN PC Plus to Abacus (which facilitates automated compounding of TPN solutions using bar coding methodology)
- Implementation of “Alteplase in the Home” Program to reduced emergency room visits for occluded intravenous access devices.
- Creation of centralized oversight for equipment systems among three HCS service lines: HomeMed, MedEquip, WSS

Academic and Professional Activities

HomeMed continues to contribute to the education of Health Science students. There were 6 student placements at HomeMed (i.e., 5 Pharmacy, 1 Dietetics) in FY '07 and 2 staff members presented one or more lectures in the College of Pharmacy and School of Nursing. Two pharmacy interns and one dietetic intern were employed at the pharmacy and there were two active Doctor of Pharmacy student research projects precepted by HomeMed staff.

Professional staff made presentations at the local, regional and national level. One pharmacist published an article on USP 797 Compliance for the home infusion industry. Two staff members serve as professional association board of directors at the national level and four staff members serve on various national professional association committees.

HomeMed has also supported through participation and sponsorship the Hemophilia Foundation of Michigan and Trail's Edge Camp for Ventilator Dependent Children.

HomeMed Leadership

Director

Christopher J. Maksym – HomeMed, MedEquip, WSS

Managers

Tricia Sirois – Pharmacy & Operations

Michelle Barnett – Reimbursement

Debbie Kovacevich – Infusion Nursing

Supervisors

Terrilyn Cook – Medical Records, Office, Facilities
Lisa Klein – Pharmacy Technicians
Eric Korte – Inventory, Warehouse & Shipping
Aaron Markham – HCS Equipment Systems
Mary Quick – Billing & Collections

***** END OF UMHS DEPARTMENT OF PHARMACY SERVICES ANNUAL REPORT FY2007 *****