ABSTRACTS

American College of Clinical Pharmacy
2001 Spring Practice and Reseach Forum
April 22–25 ▪ 2001
Grand America Hotel
Salt Lake City ▪ Utah

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Encore Presentations: Abstracts marked with an "E" are Encore Presentations. Encore Presentations undergo the same peer review process as do Original Presentations, but may have been presented elsewhere or published in abstract form only prior to the 2001 Spring Practice and Research Forum. For Encore Presentations, the abstract title, authors, and original citation (if provided) are published in *Pharmacotherapy*. The full abstract will be published in the meeting program book.

ORIGINAL RESEARCH

These papers describe original research in therapeutics, pharmacokinetics, pharmacodynamics, pharmacoeconomics, pharmacoepidemiology, and pharmacogenomics.

Adverse Drug Reactions/Drug Interactions

1. An adverse drug event detection tool developed through integrating clinical information systems and the clinical problem list: results of a pilot program. *Michael A. Shullo, Pharm.D.,* Robert J. Weber, M.S., Margaret M. Verrico, B.S., Terry P. McKaveney, B.S., Melissa Saul, Randy P. Smith Ph.D.; UPMC – Presbyterian, Pittsburgh, PA.

PURPOSE: Studied adverse drug events (ADEs) rates vary from 2.1% to 41% of hospital admissions. A process improvement effort was initiated to develop and pilot a detection tool that would further examine the rate of ADEs, improve ADE detection, and possibly decrease the incidence of preventable ADEs in the future. This pilot program: 1) uses the problem-oriented approach; 2) integrates information from clinical systems; and 3) is easy to use in prospective chart review on a patient care unit.
METHODS: The ADE detection tool integrated patient demographics, a clinical problem screen, ADE documentation, and follow up. Demographic and clinical information were extracted daily from the institution's data warehouse and imported into a relational database where it was combined with previously collected ADE information to generate a data collection form. Clinical problems (e.g., hypokalemia, increased BUN/Cr, thrombocytopenia, GI disturbances, and rash) identified during chart review were examined further to determine if an ADE occurred. Adverse drug event management and outcomes were documented in the follow-up section of the form to facilitate review by an accepted ADE probability scale.
RESULTS: The detection tool was used to screen 38 patients from a GI surgery/liver transplant unit on testing days. Fourteen ADEs were detected at a rate of 36.8% of admissions. The most common drug associated with an ADE was tacrolimus and the most common ADE was diarrhea.
CONCLUSIONS: This new approach to proactive ADE detection and evaluation appears promising in determining the true rate and causes of ADEs.

2E. Cocktail purpura and OTC quinine as causes for severe blood dyscrasias: two unusual case presentations. *Dorothea C. Rudorf, Pharm.D., M.S.*; Massachusetts College of Pharmacy and Health Sciences; Beth Israel Deaconess Medical Center, Boston, MA.

Published in Pharmacotherapy 2000;20:1230–1.

3. Hospital admissions resulting from potentially preventable adverse drug reactions. *Patrick J. McDonnell, Pharm.D.,* Michael R. Jacobs, Pharm.D.; Temple University, Philadelphia, PA.

PURPOSE: This study assessed the potential preventability of adverse drug reactions (ADRs) directly relating to a patient's hospital admission.
METHODS: Medical records of 437 patients in which an ADR occurred between July 1, 1998, and May 31, 1999, at a university teaching hospital were reviewed. Adverse drug reactions directly related to a patient's admission were further examined to determine probability, severity, and preventability of the event.
RESULTS: During this time period, 158 (36.2%) of these ADRs were directly related to a patient's hospital admission. The relationship of these admissions due to drug exposure as being probable or highly probable was seen in 154 (97.4%) of these cases. Severe or life-threatening events accounted for 23 (24.8%) admissions. From this group, 96 (62.3%) were considered potentially preventable. Characteristics most associated with potentially preventable ADRs were documentation of a toxic serum drug level (77%), inadequate monitoring of drug therapy (67%), inappropriate dosing (52%), and patient compliance issues (33%). These admissions resulted in 595 hospital days with an average length of stay of 6.1 days. Drug-related admissions categorized as severe resulted in an increased length of stay vs those categorized as moderate (9.83 days vs 5.05 days; p=0.021).
CONCLUSION: Adverse drug reactions leading to hospital admissions are often preventable. Some were serious to life-threatening. Most resulted from inadequate monitoring of a patient's drug therapy or inappropriate dosing for that specific patient. Multidisciplinary prevention strategies among physicians, pharmacists, other health care professionals, and their patients focusing on communication and education should be targeted.

4. Pharmacists' participation increase adverse drug reaction monitoring: the Singapore experience. *Hwee L. Wee, B.S. (Hons) Pharm,* Chai L. Low, Pharm.D.; National University of Singapore, Singapore.

PURPOSE: This study was conducted to investigate the impact of implementing a new adverse drug reaction (ADR) monitoring and reporting system within a tertiary teaching hospital with active pharmacists' participation.
METHODS: A 16-week prospective study was conducted in a 957-bed acute care tertiary teaching hospital. Adverse drug reactions were monitored for all inpatients from September 1999 to December 1999. Three mechanisms for screening for potential ADRs, namely abnormal therapeutic drug monitoring values, sudden medication discontinuation/dosage reduction, and orders for tracer drugs, were introduced. All ADR reports received were evaluated by the pharmacists for causality assessment using the Naranjo's algorithm. The outcomes of reported ADR were assessed.
RESULTS: The number of reports received increased from 23 reports during the preceding 12 months to 24 reports in 4 months. Pharmacists contributed more than twice as many reports as physicians. The tracer drug mechanism produced the most number of ADR reports (14/24). Most ADRs were moderately severe and had a possible or probable causal relationship with the suspected drug. Dermatological reactions occurred most frequently (20/30).
CONCLUSIONS: With the implementation of the screening mechanisms, and the active participation of pharmacists, the ADR reporting rate at the study institution had increased significantly. The data collected also allowed the ADR pattern at the institution to be monitored. Although a multidisciplinary team has been shown to be necessary, pharmacists could and should be the main players involved in ADR monitoring and reporting systems.

5E. Safety and efficacy of sequential intravenous to oral moxifloxacin for the treatment of community-acquired pneumonia in hospitalized patients. *Shurjeel H. Choudhri, M.D.,* Alan S. Hollister, M.D., Ph.D., Dan Haverstock, M.S., David M. Weinstein, Ph.D., Patricia Jackson, Deborah Church, M.D.; Bayer Corporation, West Haven, CT.

Presented at the 1st International Meeting of Resistant Gram Positive Infections, San Antonio, TX, December 3–5, 2000.

6E. The Avelox® clinical experience study, a postmarketing observational study. *Alan Whitehouse, M.D.,* Jugroop Brar, M.D., Steven Kowalsky, Pharm.D., Renee Perroncel, Dan Haverstock, M.S., Deborah Church, M.D.; University Hospital, Augusta, GA; Bayer Corporation, West Haven, CT.

Presented at the 1st International Meeting of Resistant Gram Positive Infections, San Antonio, TX, Dec 3–5, 2000.

Analgesia

7. Investigation of intraarticular bupivacaine in major orthopedic surgery for postoperative pain control. *Michael P. Rivey, M.S.,* Howard D. Beall, Ph.D., Douglas Woolley, M.D., Paul Brand, Pharm.D., Ashley Ganser, Pharm.D., William James, B.S.; University of Montana; Community Medical Center, Missoula, MT.

PURPOSE: To determine whether bupivacaine plasma concentrations associated with use of a novel continuous intraarticular infusion of the drug following commonly used intraarticular bolus and/or regional injections in patients undergoing primary knee or hip replacement approached levels associated with toxicity. Also to quantify the impact of the drug regimen on postoperative narcotic usage and compare that impact to usage seen in historical controls.
METHODS: Samples for bupivacaine concentrations were collected at 1, 4, and 12 hours following completion of surgery in 30 patients undergoing

primary joint replacement. Plasma concentration analysis was conducted by HPLC methods; potentially toxic concentrations were considered to be above 2 µg/ml. Patients were monitored by continuous electrocardiography for signs of bupivacaine cardiotoxicity while they were receiving the bupivacaine by intraarticular infusion. Demographic and narcotic usage data were collected from patient chart review.
RESULTS: Mean patient age was 68.57 ± 7.06 years, including 18 males and 12 females. Surgery involved total hip and total knee replacement in 11 and 19 patients, respectively. Mean plasma concentrations were 0.198 ± 0.068 µg/ml at 1 hour, 0.297 ± 0.080 µg/ml at 4 hours, and 0.482 ± 0.144 µg/ml at 12 hours. No patient demonstrated signs of cardiotoxicity. Patient-controlled analgesia was not required in any patient postoperatively and narcotic usage was greatly decreased compared to historical controls.
CONCLUSION: The delivery of bupivacaine by a novel method involving use of a continuous intraarticular infusion did not result in levels associated with toxicity and decreased postoperative narcotic usage.

Cardiology

8. An evaluation of the change in electrocardiographic P-wave variables after acute caffeine ingestion in normal volunteers. *Michael F. Caron, Pharm.D.*, Jessica Song, Pharm.D., Jeffrey Kluger, M.D., C. Michael White, Pharm.D.; University of Connecticut, Storrs, CT.; Hartford Hospital, Hartford, CT.

PURPOSE: Atrial conduction measures (average P-wave duration [P-avg], maximum P-wave duration [P-max], and P-wave dispersion [P-disp]) are increased in patients with paroxysmal atrial fibrillation (AF). High-dose caffeine ingestion is associated with AF, but the mechanism is unknown. We evaluated the effects of moderate, single-dose caffeine consumption on P-avg, P-max, and P-disp.
METHODS: Caffeine naive subjects were randomized in crossover design to placebo or caffeine 400 mg. For each phase, a 12-lead electrocardiogram (ECG) was performed at baseline and 3 hour post study drug. P-avg is the average P-wave duration from all evaluable leads. P-disp was determined by subtracting P-max from the minimum P-wave duration.
RESULTS: No significant changes noted within phases or for Δ changes between groups.

	P-avg (msec)	P-max (msec)	P-disp (msec)
Placebo baseline	87.17 ± 11.91	102 ± 11.35	31 ± 8.76
Post placebo	91.03 ± 8.02	103 ± 8.23	29 ± 7.38
Caffeine baseline	93 ± 8.04	109 ± 8.76	36 ± 9.66
Post caffeine	89.58 ± 8.75	103.5 ± 14.54	34.5 ± 13.43
Δ Change placebo	-3.86 ± 8.32	-1 ± 11	2 ± 9.19
Δ Change caffeine	3.42 ± 8.37	5.5 ± 15	1.5 ± 17.65

CONCLUSIONS: Moderate caffeine ingestion in young, healthy adults does not alter P-wave variables associated with AF.

9E. Effects of sleep deprivation on neural circulatory control. *Bradley G. Phillips, Pharm.D.*, Masahiko Kato, M.D., Ph.D., Garder Sigurdsson, M.D., Catherine Pesek, D.O., Krzysztof Narkiewicz, M.D., Ph.D., Virend K. Somers, M.D., Ph.D.; University of Iowa, Iowa City, IA; Medical University of Gdansk, Poland; Mayo Clinic, Rochester, MN.

Published in J Hypertens 2000;18:S232.

11E. Systemic, but not local, propranolol infusion blocks hypoglycemic muscular insulin resistance. Robert P. Hoffman, M.D., Christine A. Sinkey, R.N., *Bradley G. Phillips, Pharm.D.*; University of Iowa, Iowa City, IA.

Published in Diabetes Res Clin Pract 2000;50:S310.

12E. Impaired insulin-induced vasodilation and sympathetic neural activation in patients with obstructive sleep apnea. *Bradley G. Phillips, Pharm.D.*, Masahiko Kato, M.D., Ph.D., Virend K. Somers, M.D., Ph.D., Robert P. Hoffman, M.D.; University of Iowa, Iowa City, IA; Mayo Clinic, Rochester, MN.

Published in Diabetes Res Clin Pract 2000;50:S101.

13. Increased transfusion rates in patients receiving pretreatment or loading doses of clopidogrel before percutaneous coronary intervention compared with historical ticlopidine controls. *Dawn Bell, Pharm.D.*, Reyaz U. Haque, M.D., Ken Jozefczyk, M.S.; West Virginia University; Ruby Memorial Hospital, Morgantown, WV.

PURPOSE: To examine the rate of blood transfusions in percutaneous coronary intervention (PCI) patients receiving pretreatment or loading doses of clopidogrel (C) compared with historical ticlopidine (T) controls.
METHODS: This is a retrospective, observational study comparing transfusion rates in patients receiving C 300 mg load, 3–5 days pretreatment with 75 mg/day of C, or T 250 mg twice daily for PCI with stent placement. Data were abstracted from a central database using ICD-9 codes. Patients who received a platelet glycoprotein IIb/IIIa inhibitor were excluded. All nominal data were compared using Chi-squared analysis and the Kruskall-Wallis test was used for all other comparisons. Calculations were performed using JMP for the Macintosh.
RESULTS: A total of 846 patients received T and 248 C. Transfusion rates in patients receiving C were significantly higher than in patients receiving T (9.3% vs 5.9%; p=0.04). Patients requiring transfusion were older and more likely to be female than patients who did not require transfusion, but there were no significant differences in demographic characteristics between the two groups.
CONCLUSIONS: Patients receiving C loading or pretreatment had significantly higher transfusion requirements than did patients receiving T. There is little evidence in the published literature to documenting the safety of this dosing regimen of C in patients receiving PCI with stent. This study suggests that these regimens of C may predispose patients to an increase risk of bleeding in clinical practice. Research on the safety of potent platelet inhibitors during PCI is needed.

14. The effect of HMG-CoA reductase inhibitors on exercise capacity in congestive heart failure. *Barry E. Bleske, Pharm.D.*, Min Zhang, Pharm.D., Robert Bard M.S., John M. Nicklas, M.D.; University of Michigan, Ann Arbor, MI.

Coenzyme Q10 (CoQ10) is an antioxidant and plays an important role in the synthesis of ATP. HMG-CoA reductase inhibitors (statins) reduce CoQ10 levels. Theoretically, the administration of statin therapy in patients with congestive heart failure (CHF) may reduce CoQ10, resulting in a decrease in ATP which may exacerbate CHF symptoms and decrease exercise capacity.
PURPOSE: To perform a preliminary evaluation to determine if HMG-CoA reductase inhibitors decreases peak oxygen uptake (VO_2), a measurement of exercise capacity, in patients with CHF.
METHODS: This retrospective study in ischemic cardiomyopathy patients undergoing treadmill exercise testing using a ramped protocol. Inclusion criteria included a diagnosis of CHF > 6 months, statin therapy > 1 month, and respiratory exchange ratio ≥ 1.10 with resting and recovery data measured. Exclusion criteria included chronic obstructive pulmonary disease and obesity.
RESULTS: A total of 39 patients were identified; 23 were receiving statin therapy (group A) and 16 were not (group B). Baseline characteristics were similar between group A and group B, including ejection fraction (22 ± 5% vs 24 ± 5%), functional class (2.3 ± 0.6 vs 2.1 ± 0.9), ACE-inhibitor therapy (90% vs 84%), and digoxin therapy (78% vs 76%). Peak exercise heart rate and respiratory exchange ratio were also similar between group A and B (134 ± 18 vs 134 ± 24 beats/minute and 1.2 ± 0.07 vs 1.23 ± 0.11; p>0.4, respectively). However, peak VO_2 was significantly lower in group A compared to group B (15.10 ± 3.2 vs 17.8 ± 5 ml/kg/minute; p=0.024). In addition, there was a lower ventilation threshold observed in group A compared to group B (10.2 ± 2.2 vs 11.2 ± 2.5 ml/kg/minute; p=0.09).
CONCLUSIONS: Ischemic cardiomyopathy patients receiving statin therapy had a significantly lower exercise capacity as measured by peak VO_2 as compared to those patients not receiving statin therapy. These data suggest that further prospective studies evaluating the effect of statin therapy in heart failure patients regarding outcomes beyond lipid lowering and including functional ability, symptoms, and the effect on CoQ10 are warranted.

15. Appropriateness of amiodarone monitoring at a Veterans Affairs medical center. *Maqual R. Graham, Pharm.D.*, Marcia A. Wright, Pharm.D.; Veterans Affairs Medical Center–Kansas City; University of Missouri at Kansas City, Kansas City, MO; Pfizer Inc., New York, NY.

PURPOSE: Parameters suggested for appropriate amiodarone monitoring were collected to determine adherence rates with published recommendations and identify opportunities for improvement in medication management.
METHODS: A computer-generated list was obtained to identify patients receiving an amiodarone prescription in a 6-month period. Both electronic and paper medical records were reviewed. Demographics, clinical data points including pulmonary function test, chest x-ray, electrocardiogram and eye examination, laboratory values, and interacting medications were abstracted.
RESULTS: One hundred forty patients were identified. However, 52 patients were excluded; 28 were initiated on amiodarone 3 months before review; 14 patients had therapy discontinued; 6 expired; and 4 were lost to follow up. Sixty-three percent of the 88 patients reviewed received amiodarone for atrial fibrillation or flutter and maintained on therapy for an average of 1.8 years. Thirteen, 23, 16, 29, 42 and 44% of patients had pulmonary function tests, chest x-ray, eye examination, thyroid function, liver function, and electrocardiogram assessed at baseline, respectively. Eighty-eight, 77, 84, 32, 26, and 22% of patients had no evidence of monitoring for pulmonary function tests, chest x-ray, eye examination, thyroid function, liver function, and electrocardiogram, respectively. Three interacting medications were identified and include digoxin, warfarin, and phenytoin. Average drug levels or INR were in therapeutic range for the three interacting medications.
CONCLUSION: Inconsistent and inappropriate monitoring of amiodarone occurs at this medical center with low adherence to recommended guidelines. Specialized amiodarone clinics are associated with improved monitoring; therefore, a pharmacist-run amiodarone clinic has been established.

16. Influence of ischemic heart disease etiology on clinical response to short-term milrinone in patients with decompensated heart failure. *Jo E. Rodgers, Pharm.D.,* J. Herbert Patterson, Pharm.D., Kirkwood F. Adams, Jr., M.D.; University of North Carolina, Chapel Hill, NC.

PURPOSE: Short-term inotropic support has been used to improve signs and symptoms of severe heart failure (HF). Although benefit of this therapy varies among patients, whether or not HF etiology can predict response to therapy is unknown.
METHODS: Patients with New York Heart Association (NYHA) class III-IV HF requiring inotropic therapy were enrolled. Patients were assessed before receiving milrinone (per standard hospital protocol) and 30 days following therapy. Assessments included left ventricular ejection fraction (LVEF) and end diastolic volume (EDV), 6-minute walk (6MW), patient-assessed visual analog scale (VAS; 1–10; 10 best), and study personnel-assessed clinical assessment scale (CAS; 1–5; 5 best), and HF scale (HFS; 0–26; 0 best). The primary endpoint was change in LVEF between the two etiologic groups.
RESULTS: Twenty-one patients (18 males, 3 females) with ischemic (n=12) or nonischemic (n=9) HF admitted with severe decompensation (mean NYHA class 3.4) were enrolled. The average milrinone dose and duration were 0.39 µg/kg/minute and 77 hours, respectively. Standard HF therapy included angiotensin-converting enzyme inhibitors, digoxin, and β-blockers. Assessing both etiologic groups (n=21), there was significant improvement in 6MW (566 to 934 meters; $p<0.02$), VAS (4.5 to 7; $p<0.03$), CAS (2.5 to 4; $p<0.0006$), and HF scale (9 to 6; $p<0.008$). However, there was no significant difference between ischemic and nonischemic patients in change in mean LVEF (0.90 ± 2.6, 1.0 ± 8.2, $p=0.17$) or other secondary endpoints.
CONCLUSIONS: Despite the significant symptomatic improvement with short-term milrinone in the entire study group, there was no difference in response between ischemic and nonischemic HF patients in this small sample size.

17. A 24-hour ambulatory blood pressure comparison and cost analysis in patients switched from amlodipine to nisoldipine. *Thomas L. Lenz, Pharm.D.,* Richard L. Wurdeman, Pharm.D., Daniel E. Hilleman, Pharm.D., Syed M. Mohiuddin, M.D.; Cardiac Center of Creighton University, Omaha, NE.

PURPOSE: This study evaluated 24-hour blood pressure control, using an ambulatory blood pressure (AMBP) monitor, and adverse effects in patients with essential hypertension when switched from the dihydropyridine calcium channel blockers amlodipine to nisoldipine.
METHODS: Stages I or II hypertensive patients stabilized on amlodipine 5 mg or 10 mg for a minimum of 3 months were monitored for 24 hours with an AMBP monitor. The following day, patients were switched to nisoldipine 10 mg (≥ 65 years old) or 20 mg (< 65 years old). Patients were monitored at 2-week intervals for blood pressure, heart rate, side effects, and compliance. After 8 to 16 weeks, the 24-hour AMBP monitor was again placed to evaluate nisoldipine blood pressure control. Systolic and diastolic AMBP monitor results for daytime, nighttime, and total 24 hours were calculated.
RESULTS: No significant difference existed in amlodipine vs nisoldipine in any of the groups studied ($p>0.05$) except for the 24-hour diastolic blood pressure ($p<0.05$). The 24-hour average diastolic blood pressure difference was 2 mm Hg (nisoldipine, 77 mm Hg vs amlodipine, 75 mm Hg). Cost analysis showed that patients taking amlodipine 2.5 mg or 5 mg pay about 27% more than patients taking nisoldipine (any dose). The cost differences increases to 54% for patients taking amlodipine 10 mg vs nisoldipine (any dose). This extrapolates to a yearly cost savings of $135 and $420, respectively, when patients are switched from amlodipine to nisoldipine.
CONCLUSION: This study showed that both amlodipine and nisoldipine have similar clinical efficacy with a substantial cost difference favoring nisoldipine.

18E. Conversion of recent-onset atrial fibrillation with intravenous amiodarone: a meta-analytic evaluation. *Daniel E. Hilleman, Pharm.D.,* Sarah A. Spinler, Pharm.D.; Creighton University, Omaha, NE; Philadelphia College of Pharmacy, Philadelphia, PA.

Published in Chest 1999;116(Suppl 2):253S.

19. Cost-effectiveness evaluation of fixed-dose combination of angiotensin-II receptor blockers with and without hydrochlorothiazide. *Daniel E. Hilleman, Pharm.D.*; Richard L. Wurdeman, Pharm.D.; Thomas L. Lenz, Pharm.D.; Creighton University Cardiac Center, Omaha, NE.

PURPOSE: To compare the cost-effectiveness of the three commercially available fixed-dose combinations (FDC) of angiotensin-II receptor blockers (ARBs) with hydrochlorothiazide (H).
METHODS: Published randomized, controlled trials with FDC of losartan (L), telmisartan (T), and valsartan (V) with H were identified by MEDLINE search. Pooled estimates of systolic blood pressure (SBP) and diastolic blood pressure (DBP) lowering and response rates were calculated using the meta-analytic technique of Cochran and DerSimonian with sample size and variance adjustments. Average reductions in SBP and DBP and average response rates were used to calculate cost-effectiveness ratios expressed as dollars per mm Hg reduction and dollars per successfully treated patient.
RESULTS: A total of 3883 patients were included in 14 trials with 1371 receiving L (8 cohorts), 1309 receiving T (2 cohorts), and 1203 receiving V (4 cohorts). Pooled estimates of SBP and DBP lowering and response rates and cost-effectiveness ratios were:

Drug/Dose	Δ SBP mm Hg	Δ DBP mm Hg	Response Rate (%)	Annual AWP* ($)	$ per mm Hg Δ SBP	$ per mm Hg Δ DBP	$ per % Response Rate
V80	8.89	4.51	54	575	53	105	877
V160	10.19	5.30	59	511	50	96	866
V80/H12.5	14.59	7.71	64	511	35	66	798
V160/H12.5	15.84	9.39	76	537	34	57	706
L50	8.5	4.65	41	474	56	102	1156
L100	8.83	4.72	44	712	81	151	1618
L50/H12.5	10.92	7.3	58	474	43	65	817
L100/H25	12.35	8.45	63	712	58	84	1130
T40	9.30	6.40	60	482	52	75	803
T80	12.5	7.10	66	482	39	68	730
T40/H12.5	17.40	11.70	81	482	28	41	595
T80/H12.5	18.80	12.30	85	482	26	39	567

*AWP = average wholesale price

CONCLUSIONS: All doses of FDC of ARB plus H are more cost-effective than ARB alone, except L100/H25, which is more cost-effective than L100, but not L50. T80/H12.5 is the most cost-effective ARB/H FDC.

20. Higher usage of aspirin and β-blockers within 24 hours of admission with acute myocardial infarction in an inner-city hospital compared to statewide data. N.C. Bhalodkar, M.D., FACP, FACC, M.A. Beato, M.D., E. Brown, Jr., M.D., S. Blum, Ph.D., K. Kim, Pharm.D., *Peter Lao, B.S., BCPS,* G.E. Keriaky, M.D.; Bronx Lebanon Hospital Center; Albert Einstein College of Medicine; Bronx, NY.

PURPOSE: Among patients with acute myocardial infarction (AMI), appropriate medications are underused within first 24 hours. We examined our approach to patients with AMI in an inner-city hospital in New York City.
METHODS: A retrospective chart review of 204 consecutive patients admitted with AMI in 1997 was conducted. Patients (n=36) with septicemia, fulminant infection, and acute surgical conditions were excluded.
RESULTS: Mean age of patients was 65 ± 14 years (range 37–97), 47% were female, 39% were African American, and 56% were Hispanic. Within 24 hours of admission, 92% received aspirin whereas 69% received β-blockers. New York statewide data (all race/ethnic groups combined) collected by the New York State Cooperative Cardiovascular Project (CCP) showed that within 24 hours, aspirin was given to 75% and 81% in 1996 and 1998, respectively. β-Blockers were given within 12 hours to 39% and 48% of patients in 1996 and 1998, respectively. Compared to New York statewide data our patients were significantly more likely to receive both aspirin ($p=0.000001$ in 1996 and $p=0.0001$ in 1998) and β-blockers ($p=0.0000001$ in 1996 and $p=0.0000001$ in 1998) for the 2 comparison years.
CONCLUSIONS: In an inner-city hospital patients with AMI were significantly more likely to receive both aspirin and β-blockers on admission compared to statewide data. However, the use of β-blockers in the statewide survey was within 12 hours of admission.

21. Higher usage of aspirin, β-blocker, and angiotensin-converting enzyme inhibitors on discharge in patients with acute myocardial infarction in an inner-city hospital compared to statewide data. N.C. Bhalodkar, M.D., FACP, FACC, M.A. Beato, M.D., E. Brown, Jr. ,M.D., S. Blum, Ph.D., K. Kim, Pharm.D., *Peter Lao, B.S., BCPS,* G.E. Keriaky, M.D.; Bronx Lebanon Hospital Center; Albert Einstein College of Medicine; Bronx, NY.

PURPOSE: It has been reported that among patients with acute myocardial infarction (AMI) appropriate medications are underused on discharge. We examined our approach to patients with AMI in an inner-city hospital in Bronx, NY.
METHODS: A retrospective chart review of 204 consecutive patients admitted with AMI in 1997 was conducted. Patients (n=36) with septicemia, fulminant infection, and acute surgical conditions were excluded. Patients with LV systolic dysfunction on echocardiogram were considered eligible for angiotensin-converting enzyme (ACE) inhibitors. Nine patients expired during hospitalization.
RESULTS: A total of 159 patients were discharged from hospital. Mean age of patients was 65 ± 14 years (range 37-97), 46% were female, 40% were African American, and 56% were Hispanic. On discharge, 97% were prescribed aspirin, 94% of eligible patients were prescribed ACE inhibitors, and 66% were prescribed β-blockers. New York statewide AMI baseline data showed that at discharge 71%, 63%, and 63% of patients were prescribed aspirin, ACE inhibitors, and β-blockers, respectively. Compared to New York statewide data, our patients were significantly more likely to receive both aspirin ($p<0.00001$) and ACE inhibitors ($p<0.00001$) while they were as likely to receive β-blockers 66% vs 63% ($p=0.54$).
CONCLUSIONS: In an inner-city hospital, patients with AMI were significantly more likely to receive both aspirin and ACE inhibitors on

discharge, compared to statewide data, and were as likely to receive β-blockers.

22. Platelet glycoprotein IIb/IIIa inhibitors increase the percentage of COAT-platelets binding high levels of both factor V and fibrinogen on co-stimulation of the collagen and thrombin receptors. *Stephen F. Hamilton, Pharm.D., FCCP,* George L. Dale, Ph.D.; University of Oklahoma; Warren Medical Research Institute, Oklahoma City, OK.

Platelets co-stimulated with collagen and thrombin produce a unique subset of activated platelets called COAT-platelets (Blood 2000; 95:1694) which bind high levels of adhesive and procoagulant α-granule proteins to their surface. Early observations, in this laboratory, not only suggested that 7E3 was unable to displace these adhesive and procoagulant proteins from COAT-platelets, but actually increased the percentage of COAT-platelets produced. Therefore, this study systematically tested the effect of abciximab, tirofiban eptifibitide, and DMP-802 on COAT-platelet production with respect to the binding of endogenous factor-V, endogenous fibrinogen, and exogenous fibrinogen. Gel filtered human platelets simultaneously activated with convulxin (specific agonist for the platelet glycoprotein-VI collagen receptor) and thrombin were analyzed by flow cytometry to determine the percentage COAT-platelets produced with or without the various platelet glycoprotein IIb/IIIa inhibitors (n=10 for each inhibitor and protein combination). In the absence of a platelet glycoprotein IIb/IIIa inhibitor, the mean percent ± SD for COAT-platelet production was 27.20% ± 6.43% across all experiments. COAT-platelet production increased in the presence of each platelet glycoprotein IIb/IIIa inhibitor; $p<0.006$ for each comparison, except DMP-802 where $p<0.04$. For example, the relative increase in mean COAT-platelets over the individual control values, with respect to endogenous fibrinogen binding, in the presence of abciximab, tirofiban, eptifibitide, and DMP-802 was 1.53-, 1.18-, 1.21-, and 1.11-fold, respectively. Similar statistically significant results were found with respect to exogenous fibrinogen and endogenous factor-V binding to COAT-platelets. In conclusion, each of the platelet glycoprotein IIb/IIIa inhibitors increased COAT-platelet production with the greatest increase promoted by abciximab.

23E. The effect of abciximab administration on the in-hospital, 30-day, and 6-month outcomes of percutaneous coronary intervention for acute myocardial infarction: a report of the CVC.NMH registry. Dominic A. Plucinski, M.D., Janet Krusmark, Karen Scheltema, *Patrick L. McCollam, Pharm.D.,* Mohan Bala, Ph.D.; Centocor, Inc., Malvern, PA; CV Consultants Ltd, Robbinsdale, MN; North Memorial Health Care, Robbinsdale, MN; Eli Lilly & Co, Indianapolis, IN.

Published in Circulation 2000;102:II-666.

24. A comparison of total hospital costs for percutaneous coronary intervention patients receiving abciximab vs tirofiban. *Patrick L. McCollam, Pharm.D.,* Maureen J. Lage, Ph.D., Mohan Bala, Ph.D.; Eli Lilly & Co, Indianapolis, IN; Centocor, Inc., Malvern, PA.

PURPOSE: Examine total hospital costs (TCosts) associated with receipt of abciximab vs tirofiban in percutaneous coronary intervention (PCI) patients.
METHODS: Data were from HCIA-Sach's Clinical Pathways Database (July 1998 through June 1999). Inclusion criteria: hospital billing data present, primary procedure of PCI with abciximab or tirofiban. Multivariate analysis was used to control for factors that may influence TCost. A two-stage sample selection model (SSM) was used to estimate TCosts. The first used probit regression to determine factors associated with the probability of receiving abciximab versus tirofiban. The second stage examined factors associated with costs, while controlling for unobserved factors potentially correlated with the probability of receiving abciximab.
RESULTS: Mean unadjusted TCost, including drug cost, was $10,762 (n=3967); abciximab $10,813, tirofiban $10,567. After controlling for high-risk indications and selection bias with the SSM, there was no significant difference in TCosts associated with receipt of abciximab vs tirofiban. Results also indicate the SSM may not be needed hence, TCost was re-estimated using ordinary least squares (OLSs). With OLS analysis, receipt of abciximab versus tirofiban significantly reduced TCosts ($470 reduction; p=0.05).
CONCLUSIONS: This study used "real world" data to examine TCosts for PCI patients who received abciximab vs tirofiban. The SSM indicates no difference in TCosts (including drug costs) between abciximab- and tirofiban-treated patients. If the OLS model is considered, a slight decrease in TCosts is observed in abciximab recipients. Cost-containment strategies which focus on component costs alone may not lead to intended overall cost-savings.

Critical Care

25. In vivo effects of ranitidine and omeprazole on T-lymphocyte proliferation and immune-modulation. *Jill A. Rebuck, Pharm.D.,* Kimberly L. Bergman, Pharm.D., Samuel J. Pirruccello, M.D., Keith M. Olsen, Pharm.D., FCCP; University of Nebraska Medical Center, Omaha, NE.

INTRODUCTION: Immune-modulation differences between histamine antagonists and proton pump inhibitors are important in patients with impaired cell-mediated immunity, including post-trauma or those undergoing major surgery.
HYPOTHESIS: In vivo differences exist in immune-modulating response of ranitidine and omeprazole.
METHODS: Ten healthy subjects (eight male/two female; mean age: 28.4 ± 6.8 years) were randomized in crossover fashion to 7 days of omeprazole 20 mg/day or ranitidine 150 mg twice daily followed by at least a 1-week drug-free interval between treatment arms. T-lymphocyte proliferation was assessed, as well as differentiation of lymphocyte phenotypes and comparison of mononuclear cell counts. Peripheral blood mononuclear cells (PBMC) were isolated using centrifugation techniques over a ficoll-hypaque density gradient and counted at each time point (baseline, after completion of each treatment arm, and following the drug-free interval). Lymphocyte proliferation assays were performed following a 72-hour phytohemagglutinin stimulation, with ^{3}H-thymidine incorporation during the final 4 hours of incubation. The following were compared between treatment and baseline: mononuclear cell counts, differentiation of lymphocyte phenotype, and T-lymphocyte proliferation studies.
RESULTS: Mean percentage change from baseline PBMC counts were increased after omeprazole therapy (4% and 12%) and decreased after ranitidine therapy (-4% and -9%; $p>0.05$). A four-fold difference in mitogen-stimulated ^{3}H-thymidine uptake following omeprazole therapy was observed ($p<0.0001$), whereas ranitidine diminished thymidine uptake response ($p=0.12$). The mean CD_4/CD_8 ratio was uninfluenced by administration of either antisecretory agent.
CONCLUSIONS: Enhanced in vivo immune modulation was exhibited after omeprazole administration compared to ranitidine, as measured by increased mononuclear cell counts and T-lymphocyte proliferation.

26E. Tolerability of bolus vs continuous gastric feeding in brain injured patients. *Denise H. Rhoney, Pharm.D.,* Dennis Parker, Jr., Pharm.D., Christine Formea, Pharm.D., Christina Yap, R.D., William M. Coplin, M.D.; Wayne State University, Detroit, MI.

Presented at the 30th International Education & Scientific Symposium of the Society of Critical Care Medicine, San Francisco, CA, February 10–14, 2001.

27. Variation of bispectral index values in chemically paralyzed patients. Sandra L. Kane, Pharm.D., Anthony T. Gerlach, Pharm.D., Charles H. Cook, J.D., Garth Essig, B.S., *Joseph F. Dasta, M.S., FCCP*; The Ohio State University, Columbus, OH.

PURPOSE: Prospective evaluation of chemically paralyzed patients to determine the depth of sedation using a bispectral index (BIS) monitor.
METHODS: Bispectral index monitoring was performed for 1 hour in ten patients chemically paralyzed for > 12 hours. Major external stimuli were minimized, medication dosages kept constant, and BIS readings were downloaded into a computer every 5 seconds throughout the hour. Patients excluded were those with cerebral ischemia, liver failure, stroke, or facial lacerations. Medications and dosages administered for sedation, analgesia, and paralysis were documented.
RESULTS: Ten patients (nine female) 53 ± 16 years old, weighing 105 ± 53 kg, and admitting APACHE 33 of 28 ± 8 were evaluated. All patients received cisatracurium, average dose 2.9 ± 1.3 µg/kg/minute, resulting in train of four scores (number of patients) of 1 (1), 3 (1), 4 (3), 0 (3), and not available (2). Nine patients received lorazepam, average dose 1.6 ± 0.6 mg/hour and a cumulative dose of 29 ± 12 mg in the previous 24 hours. One patient received propofol. Analgesics included hydromorphone, morphine, and fentanyl. Two patients did not receive an analgesic. The highest BIS value was 97 and the lowest 0. Patients' largest range (maximum–minimum value) was 62 and the smallest 6 with an average range of 35 ± 18. The patient with a range of 62 received hydromorphone and had the highest dosage of lorazepam (2.5 mg/hour).
CONCLUSION: An objective tool for monitoring depth of sedation during chemical paralysis could be useful in guiding sedation; however, variability of BIS values is substantial.

28E. Outcome of vasopressin treatment in vasodilatory septic shock. *Henry J. Mann, Pharm.D.,* Gregory J. Beilman, M.D., Jin Bom Song, M.S., J. Brad Farrell, Pharm.D., Ian K. Hasinoff, M.D., Bruce C. Lohr, Pharm.D.; University of Minnesota; Fairview-University Medical Center, Minneapolis, MN.

Presented at the 30th International Education & Scientific Symposium of the Society of Critical Care Medicine, San Francisco, CA, February 13, 2001.

Drug Delivery

29. Pharmacokinetics of lorazepam after intranasal, intravenous, and intramuscular administration. Daniel P. Wermeling, Pharm.D., *Jodi L. Miller, Pharm.D.,* Sanford M. Archer, M.D., Jose Manaligod, M.D., Anita C. Rudy, Ph.D.; University of Kentucky, Lexington, KY.

PURPOSE: To determine whether intranasal (IN) administration of

lorazepam would provide comparable bioavailability and pharmacokinetics (PK) with respect to intravenous (IV) and intramuscular (IM) delivery routes at an equivalent dose.
METHODS: Twelve healthy volunteers consented to participate in this randomized, crossover study. On three occasions, each separated by a 1-week washout, subjects received a 2 mg dose of lorazepam by IN, IV, or IM routes. Blood samples were collected serially from 0 to 36 hours. Plasma concentrations were determined by LC/MS/MS analysis. Noncompartmental methods were used to determine PK parameters.
RESULTS: Mean (% CV) are given except for T_{max} where median (range) is given for the three administration routes.

Parameter	IV	IM	IN
T_{max} (hours)	0.1 (0.083-1.017)	3 (0.5-8.017)	0.5 (0.25-2)
C_{max} (ng/ml)	47.57 (57.8)	22.58 (28.9)	21.38 (24.3)
$t_{1/2}$ (hour)	16.6 (27.3)	17.4 (38.1)	18.5 (28.3)
AUC_{0-t} (ng•hr/ml)	386.8 (19.4)	372.8 (16.4)	288.0 (25.4)
$AUC_{0-\infty}$ (ng•hour/ml)	500.8 (30.8)	506.2 (33.7)	393.5 (38.0)
CL or CL/F (L/hour)	4.3 (27.0)	4.3 (28.5)	5.7 (31.8)
F (%)	assume 100%	100.9 (10.2)	77.7 (11.1)

CONCLUSION: Lorazepam appears to be well absorbed intranasally with a bioavailability of 77.7%. It has a faster absorption rate than IM, and comparable elimination profiles with IV and IM delivery. No significant adverse effects or nasal pathology were observed. This study has demonstrated favorable PK of IN lorazepam in relation to existing standard administration methods and suggests IN lorazepam may provide an alternate, noninvasive delivery route. This work was supported by Inhalation Technology, Inc.

Drug Information

30. Paperless filing system: the virtual library. *Elaine Chiquette, Pharm.D.*, Geraldine Anastasio, Pharm.D., Chris Chalmers, Pharm.D., Scott Charland, Pharm.D., Ricardo Grinberg-Funes, Ph.D., Gigi Le-Ta, Pharm.D., Susan Lignell, Pharm.D.; Roche Laboratories, Nutley, NJ.

PURPOSE: Efficient retrieval of drug- and disease-related evidence is a core activity for the pharmaceutical industries clinical medical affairs personnel in the field. In this era of information overload, paper filing systems are cumbersome, time consuming, and impractical. To facilitate article retrieval and filing, we created a virtual/electronic library (VL) for orlistat on a CD-ROM.
METHODS: First, we evaluated the adaptability, memory, and relational capabilities of three commercially available reference manager. Second, we identified all orlistat publications searching electronic databases. Two reviewers selected citations for the library according to predetermined eligibility criteria. Third, after review of the fulltext, four reviewers assigned a category to each citation. Fourth, citations were downloaded into the reference manager and linked to their respective uniform resource locator (URL) address or portable document format (pdf) format for full text retrieval.
RESULTS: The VL is an electronic repository of all relevant orlistat citations using Procite™ as the reference manager. The VL consists of more than 200 citations relevant to orlistat, each categorized and linked to an electronic fulltext version. The VL includes a search engine that allows free text searches or advanced searches using Boolean terms. The categorization of each article allows the user to quickly identify all orlistat citations relating to a particular endpoint, disease state, or population. The VL allows the users to efficiently generate a bibliography of targeted citations.
CONCLUSIONS: In our practice the VL facilitates the electronic filing and retrieval of orlistat publications that can be adapted for other drugs and disease states.

31. Limitations of using generic name only when preforming a MEDLINE search for drug information. *Wanda J. Kilzer, Pharm.D., BCPS*, Tatjana Jelic, Pharm.D. candidate; University of Oklahoma, Oklahoma City, OK.

PURPOSE: To determine the importance of searching the literature for drug information by using generic name alone vs including U.S. brand, international brand, formula, and chemical names.
METHODS: MEDLINE searches were performed for more than 90 drugs. Separate searches were performed for each drug in the following categories: generic, U.S. brand, international brand, formula, and chemical names. Boolean terms were used to determine the number of missed articles: 1) by using the generic name only; and 2) when international brand, formula, and chemical names were excluded. A subanalysis was preformed on the missed articles to determine the usefulness (defined as the number of human-related articles published in English). The "usefulness" analysis was performed for all drugs with more than 20% misses.
RESULTS: In 11% of the studied drugs, more than 20% of the articles were missed when searching by generic name alone. Including U.S. brand name in the search strategy increased the amount of retrieved articles by 32.4%. Of those, 73.4% were human-related articles published in English. Including the international brand, chemical, and formula names achieved an additional 14%. Only half of those were human-related articles published in English.
CONCLUSIONS: Routine searches should include the brand name in addition to the generic name as this contributes a significant number of additional useful articles. To perform a comprehensive search of the literature, U.S. brand, international brand, chemical, and formula names should all be used.

Education

32. Assessment of an antiretroviral adherence sensitivity training exercise in the Doctor of Pharmacy curriculum. *Douglas Slain, Pharm.D.*, Diane Casdorph, B.S., Thomas McIntire, B.S., MBA; West Virginia University, Morgantown, WV.

PURPOSE: Studies have shown that adherence and HIV viral suppression are closely linked. Unfortunately, numerous reports indicate that health care professionals have difficulty understanding the adherence problems that HIV patients may encounter. The purpose of this project was to assess the value of performing an antiretroviral adherence sensitivity training exercise in the doctor of pharmacy curriculum. In addition, students' ability to adhere to a simulated antiretroviral regimen was measured.
METHODS: Sixty-five third-year pharmacy students were written prescriptions for 7 days of a placebo antiretroviral regimen. Each student was given licorice- and cinnamon-flavored candy that represented Combivir® (zidovudine 300 mg/lamivudine 150 mg), 1 tablet q12h and indinavir 400 mg, 2 tablets q8h. They were instructed that indinavir should be taken on an empty stomach (1 hour before a meal or 2 hours after a meal), and that they should drink at least six glasses of water a day to reduce the risk of renal complications. The students' adherence with these regimens and restrictions were measured and compared with that of real HIV patients.
RESULTS: The median adherence rate with Combivir was 92.8% (range: 43–100%), and 85.7% (range: 29–100%) with indinavir. Reasons for nonadherence were very similar to those quoted by HIV patients, suggesting a sympathetic link to a real life experience. An anonymous survey found that > 90% of the students believed that the exercise was beneficial.
CONCLUSIONS: The antiretroviral adherence exercise is a valuable tool to educate pharmacy students regarding real-life restrictions that HIV patients have with antiretroviral adherence.

33. Prepharmacy predictors of success in pharmacy school: biomedical sciences, pharmaceutical sciences, management/behavioral, pharmacotherapy, team/group, and practice/clerkship courses. David Allen, Ph.D., R.Ph., *C.A. Bond, Pharm.D., FASHP, FCCP*; Texas Tech University Health Sciences Center, Amarillo, TX.

PURPOSE: Good admissions decisions are essential for identifying successful students and good practitioners. Various parameters have predictive value for academic success. Previous academic performance, the Pharmacy College Admissions Test (PCAT), and specific prepharmacy courses are academic performance indicators. However, critical thinking (CT) abilities have not been evaluated.
METHODS: We compared the California CT Skills Test (CCTST), the aforementioned parameters, and our interview score to academic performance. A simple regression model was employed.
RESULTS: N=241 students total (4 years). We confirm previous reports but demonstrate intriguing results in predicting practice based skills. CT skills predict practice-based course success. Overall SOP grade point average (GPA; all courses) was best predicted by overall prepharmacy GPA (Pearson correlation [PC] = 0.52; $p<0.001$), prepharmacy-required GPA (PC = 0.299; $p<0.001$), and PCAT (PC = 0.224; $p<0.001$). The strongest predictors of pharmacy practice courses and clerkship success were PCAT (PC = 0.237; $p<0.001$) and CCTST (PC = 0.201; $p<0.001$). Also, the CCTST and PCAT (PC = 0.448; $p<0.001$) are closely related in our students. These findings and other analyses suggest PCAT may predict CT skills in pharmacy practice courses and clerkships. Further study is needed to confirm this finding and determine which PCAT components best predict CT abilities.
CONCLUSION: Because only one-half of the schools of pharmacy in the U.S. require the PCAT for admission, and there are no published reports of schools of pharmacy using CT tests, these results suggest that many of our nation's schools of pharmacy may not be employing the best predictive measures for pharmacy practice and clerkship courses in their admissions process. Because pharmacy practice and clerkship courses more closely imitate actual pharmacy practices, many schools of pharmacy may not be employing the best measures of future success of pharmacy practitioners.

Endocrinology

34. Cholesterol and glycemic effects of Niaspan® in patients with type 2 diabetes. Elizabeth Addesse, Pharm.D., *Michael P. Kane, Pharm.D., BCPS*, Robert A. Hamilton, Pharm.D., Robert S. Busch, M.D., Gary Bakst, M.D., Albany College of Pharmacy; The Endocrine Group, Albany, NY.

PURPOSE: The objective of this study is to retrospectively determine the effect of Niaspan® on the lipid and glycemic control of patients with type 2 diabetes receiving the drug at a private-practice endocrinology group.
METHODS: A computerized text search for Niaspan, niacin, and nicotinic acid was performed to identify Niaspan users between January 1998 and March 2000. Identified records were manually reviewed to identify patients with type 2 diabetes who received Niaspan therapy. Drug efficacy and safety were evaluated by comparison of total cholesterol (TC), low-density lipoprotein cholesterol (LDLC), high-density lipoprotein cholesterol (HDL-C), triglyceride (TG) levels, HbA_{1c}, and transaminase levels immediately before and 6 months after the initiation of Niaspan.
RESULTS: Of 158 patients initially identified, review of individual patient records revealed 32 patients with type 2 diabetes who received Niaspan therapy. Mean patient age at baseline was 60 years with a gender distribution of 72% male. Mean daily Niaspan dose was 1040 mg; all patients were already receiving statin therapy. Niaspan use was associated with a significant increase in HDLC, a significant reduction of TGs, and no significant change of LDLC or TC. Mean HbA_{1c} levels significantly decreased from baseline by 0.5 ± 0.3% (p=0.032) despite no significant differences in the dosages or use of any antidiabetic agent. There were no significant changes in transaminase levels. Drug discontinuation occurred in a total of seven patients (21.9%), including one patient due to an increase in blood glucose levels.
CONCLUSIONS: For most patients with type 2 diabetes, Niaspan is safe and effective in treating dyslipidemia without exacerbating glycemic control.

35. Interest in a diabetes outcome study as a predictor of glycemic control. *Brian G. Sandhoff, Pharm.D.*, John A. Merenich, M.D., Marsha Raebel, Pharm.D.; Kaiser Permanente of Colorado, Aurora, CO.

PURPOSE: This study evaluated whether lack of patient interest in a diabetic outcomes study in poorly controlled type 2 diabetes patients is a predictor of poor diabetic control in the future.
METHODS: Two thousand nine hundred twenty-nine patients were screened for inclusion into a type 2 diabetes outcome study. Sixty-two patients who indicated it was inconvenient to participate and 667 patients who were not interested for various reasons were compared to 128 patients initially who participated in the diabetes outcome study. HbA_{1c} at baseline screening and follow up for those patients who did not participate because is was inconvenient or they were not interested were compared to the baseline and end of study follow up for study patients. HbA_{1c}s were considered follow up if they occurred ≥ 3 months following baseline.
RESULTS: A total of 343 (51%) patients who were not interested had follow-up HbA_{1c} values. Forty-two (68%) patients who stated it was inconvenient had follow-up HbA_{1c} values. Ninety-six (76%) patients who participated in the study completed follow up. Decreases from baseline to follow-up HbA_{1c}s were statistically significant for the study group (1.2%; p<0.001), patients not interested (0.88%; p<0.001), and for those who stated it was inconvenient (1.08%; p<0.002). However, the mean change between groups was not significantly different.
CONCLUSIONS: This study shows that a lack of patient interest to participate in a poorly controlled diabetes outcomes study does not correlate with poor diabetes control compared to those who did participate.

Geriatrics

36. Cognitive impairment associated with atorvastatin. *Deborah S. King, Pharm.D.*, Daniel W. Jones, M.D., Marion R. Wofford, M.D., MPH, Kimberly Harkins, M.D., T. Kristopher Harrell, Pharm.D., Kristi W. Kelley, Pharm.D.; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: To describe cognitive impairment associated with atorvastatin in one patient and report marked improvement with atorvastatin discontinuation.
METHODS: A 67-year-old Caucasian woman routinely followed in a hypertension referral center and treated for hypertension, dyslipidemia, hypothyroidism, and diabetes, presented with new onset cognitive impairment and dementia as reported by patient and family. Significant impairment in short-term memory was demonstrated on mental status examination.
RESULTS: Changes in behavior characterized by mood alterations, lack of interest in routine activities, diminished memory, and social impairment were reported. Two months before this visit, atorvastatin 10 mg/day was increased to 20 mg/day. The patient had been previously controlled with 10 mg with no reported adverse effects for 1 year. No changes were made in concurrent medications (levothyroxine, hormone replacement therapy, glyburide, metoprolol). Atorvastatin was discontinued, and the patient referred to geriatrics for further evaluation and cognitive testing. After dramatic improvement in mood, memory, and motivation, and a return to baseline functioning were noted by the patient and family, referral appointments were subsequently canceled. Repeat mental status examination also demonstrated remarkable improvement in short-term memory.
CONCLUSIONS: The patient had significant cognitive impairment temporally related to an increase in atorvastatin dosage. At 6 months post-discontinuation and a return to baseline, the patient has experienced no additional impairment. Additional case reports and controlled data are needed to further delineate the relationship between atorvastatin and cognitive impairment. Exploration of this relationship may be particularly important with recent data suggesting statins possess adjunctive properties such as neuroprotection and beneficial effects on cerebral circulation.

37. Increased warfarin sensitivity in major orthopedic surgery patients older than 65 years of age. *Ronald J. Jones, Pharm.D.*, Gordon H. Bokhart, Pharm.D., Steven E. Fisher, M.D.; Lutheran Health Network, Fort Wayne, IN; Ohio Northern University, Ada, OH.

PURPOSE: Previous studies of warfarin-treated patients have suggested increased risks for bleeding with age > 65. We studied the average maintenance warfarin dose and its relationship to age as well as other demographics in post major orthopedic surgery (MOS) patients.
METHODS: Major orthopedic surgery patients on a warfarin protocol (21 days, INR goal 1.7–2.5) were randomly selected for evaluation. Patients outside target INR range, on vitamin K, with interacting drugs, or having abnormal liver function were excluded. Each patient had four to six INRs and associated dosage adjustments. The mean daily (day 4 to 21) dose and dose/kg were calculated and assessed for age, weight, procedure, and other patient demographics. Multivariate linear regression analysis and univariate analysis of variance statistical methods were applied using SPSS‰.
RESULTS: There were 372 patients in the final group who met the criteria for inclusion. Of this sample, 138 were ≤ 65 (x=55, 32–65), 234, ≥ 66 (x=77, 66–99). There were significant correlations for mean daily dose with age r=-0.5, with age plus weight r=0.56 and mg/kg/day with age of r=0.25. There was a significant difference (p<0.0001) in dose (mg/kg/day) for ≤ 65 vs ≥ 66 of 0.044 vs 0.038, respectively. For this population (average weight, 86 kg) this was a daily dose difference of 0.45 mg/day. There was also a difference (p<0.0001) in dose for females vs males, ≥ 66 of 0.038 vs 0.042, respectively, (0.51 mg/day). There were no differences for doses for procedure type.
CONCLUSIONS: Dosing requirements for MOS patients for this study's target range were significantly lower for those ≥ 66 vs ≤ 65 overall and for females. When dosing warfarin in elderly female MOS patients increased warfarin sensitivity should be anticipated and may warrant more critical monitoring of patient INR and bleeding.

38. Attitudes of older Americans regarding consumer-targeted prescription medication advertising. *Jacqueline S. Marinac, Pharm.D.*, Lincoln Godfrey, D.O., Colleen Buchinger, M.D., James Wooten, Pharm.D., Sandra Willsie, D.O.; University of Health Sciences; University of Missouri at Kansas City; Truman Medical Center–West, Kansas City, MO.

PURPOSE: The purpose of this study was to survey Americans older than age 60 regarding direct consumer prescription medication advertising.
METHODS: Two hundred sixty-three Americans older than age 60 were recruited for face-to-face surveys containing 15 statements either true, false or don't know.
RESULTS: Seventy percent surveyed were female; 50% were white; and 49% were African American (AA). Eighty-eight percent have seen advertisements on television, and 82% had seen advertisements in magazines/newspapers within the past month. Sixty-two percent are "likely to read the ad"; AAs are more likely to read advertisements. Only 53% said advertising to the public is a "good idea"; men and AAs were more open to direct advertisements. Half said advertisements are "easy to understand"; only 41% could "tell for whom the medication is intended". Two-thirds were "doubtful" of the information provided. Thirty-eight percent stated "enough information regarding side effects" is provided. Seventy-eight percent admitted they would "talk with their doctor about a medication that may help them" and "take the medication if doctor prescribed". Eleven percent (whites 7%, AAs 16%) called a toll-free number, and 44% were more likely to call if a "discount or the medication is offered for free". Thirty-three percent named an Rx drug advertisement; Lipitor® 16, Viagra® 15, Claritin® 11, Celebrex® 8, Detrol® 5, Zantac® 5, Prilosec® 4, and Allegra® 4.
CONCLUSIONS: Older Americans are aware of prescription advertising with half believing direct consumer advertising is a "good idea". Two-thirds would read an advertisement, and one-third can identify a drug. Half found the information confusing, were unable to identify the indication, or intended patient population. Thus the potential role of pharmacist-based education is great.

39. Herbal product safety: survey of older Americans. *Jacqueline S. Marinac, Pharm.D.*, Lincoln Godfrey, D.O., Colleen Buchinger, M.D., James Wooten, Pharm.D., Sandra Willsie, D.O.; University of Health Sciences; University of Missouri at Kansas City; Truman Medical Center–West, Kansas City, MO.

PURPOSE: Herbal products (HPs) are a billion-dollar industry in the U.S. Older Americans are at greater risk for adverse events when taking over-the-counter remedies. The purpose was to survey Americans older than age 60 regarding HP safety.
METHODS: Two hundred sixty-three Americans older than age 60 were recruited. The face-to-face survey consisted of 18 statements either true, false or don't know. Subjects were paid $5.

RESULTS: Seventy percent surveyed were female; 50% were white; and 49% were African American. Twenty-three percent had less than high school education; 36% had completed high school; and 35% had more than 12 years of schooling. Fifty-five percent had a total family household income of $10,000 – 20,000, 28% had a household income of more than $20,000 annually. Eighty-seven percent were under a doctor's care. Twenty percent currently take some HP. A doctor prescribed it 14% of the time. Nearly two-thirds believed HPs "pose no risk to the general population". Sixty percent thought the FDA regulates HPs, with 70% believing the FDA tests HPs. Eighty-four percent knew some herbs "could be dangerous with prescription medications", yet only 27% knew that the purity of these products is questionable. Sixty-three percent knew the labeling requirement for HPs; however, only 45% knew that HP contents are not standardized. Seventy percent stated that they believed the HP must "do what it claims to do to be sold in the U.S."
CONCLUSIONS: Pharmacists and other health professionals should be aware that significant misconceptions and misinformation exist among older Americans about HPs. Most were interested in more information about HPs, providing an excellent opportunity for expanded patient education.

Hematology/Anticoagulation

40. An evaluation of the heparin concentration derived therapeutic range. *Claire I. Reinhardt, Pharm.D.*, John Koerber, B.S., Maureen Smythe, Pharm.D., Joan Mattson, M.D., Sue Westley, M.T.; William Beaumont Hospital, Royal Oak, MI.

PURPOSE: The American College of Chest Physicians (ACCP) recommends the aPTT therapeutic range be defined as the aPTT that corresponds to a heparin concentration of 0.3 to 0.7 U/ml by antifactor Xa assay. This recommendation suggests that a therapeutic range defined in this manner should be superior to traditional empiric therapeutic ranges (1.5 to 2.5 times control). This pilot study compared heparin dosage adjustments guided by a heparin concentration derived therapeutic range (HCDTR) to those guided by traditional empiric therapeutic ranges for bedside devices.
METHODS: Bedside activated clotting time (ACT) and bedside aPTT were determined in 40 patients before receiving IV heparin and once within 48 hours of heparin initiation. Plasma heparin concentration by antifactor Xa assay was performed on the patient samples obtained after heparin initiation. Two empiric aPTT therapeutic ranges were established: 1.5-2.5 times patient baseline (aPTT1) and 1.5-2.5 times mean of healthy volunteers (aPTT2). An empiric ACT therapeutic range was established at 160-190 seconds (currently in use at our institution). A HCDTR was predetermined in a separate patient population for each clotting time test. Heparin dosage adjustment decisions were evaluated by comparing each clotting time test result with the plasma heparin concentration. Decisions were in agreement when the clotting time test result and plasma heparin concentration indicated a similar change in dosage (both increase, decrease, or no change).
RESULTS: The level of agreement in dose adjustment decisions between aPTT1/heparin, aPTT2/heparin, and aPTT HCDTR/heparin were 28/39 (70%), 28/40 (72%), and 23/40 (58%), respectively (p=0.34). Level of agreement between empiric ACT/heparin and HCDTR ACT/heparin were 20/40 (50%) and 25/40 (63%), respectively (p=0.37).
CONCLUSIONS: Heparin dosage adjustments based on empiric and HCDTRs did not significantly differ for bedside aPTT or ACT. This study did not demonstrate a benefit of using an HCDTR when monitoring heparin therapy with bedside instruments.

41. Comparison of empiric and heparin concentration-derived therapeutic ranges for a laboratory based aPTT. *John M. Koerber, B.S.*, Maureen A. Smythe, Pharm.D., Claire I. Reindardt, Pharm.D., Sarah V. Meunch, B.S., Sue J. Westley, M.T., Joan C. Mattson, M.D.; William Beaumont Hospital; Wayne State University, Detroit, MI.

INTRODUCTION: The College of American Pathologists and the American College of Chest Physicians recommend the aPTT therapeutic range be determined by identifying the aPTT times which correspond to a heparin level of 0.3–0.7 U/ml. This recommendation implies that a heparin concentration derived aPTT therapeutic range (HCDTR) is superior to an empiric aPTT therapeutic range. This assumption has not been validated to date.
PURPOSE: To compare heparin dosage adjustment decisions based on a HCDTR to those based on an empiric aPTT therapeutic range.
METHODS: Data from three of our previous studies of unfractionated heparin were retrospectively reviewed. All studies had similar inclusion criteria and methods of sample collection. Each study had a HCDTR for the aPTT reagent at the time of the study. The following data were extracted: baseline laboratory-based aPTT and laboratory-based aPTT while receiving continuous infusion heparin therapy along with a paired heparin level by antifactor Xa analysis. An empiric aPTT therapeutic range was established for each patient as 1.5–2.5 times patient's baseline. Dosage adjustment decisions based on HCDTR and the empiric aPTT range were compared to those based on heparin concentration. Decisions agreed when both tests produced the same clinical decision. Agreement was assessed using a Chi-Squared test.
RESULTS: Data from 96 patients were included. Decisions based on HCDTR agreed with those based on heparin concentration in 71 patients, whereas those based on an empiric aPTT therapeutic range agreed with those based on heparin concentration in 57 patients, p=0.0461.
CONCLUSIONS: When using a laboratory-based aPTT, decisions guided by a HCDTR agree with those guided by heparin concentration more often than decisions guided by an empiric therapeutic range established using the patient's baseline aPTT.

42. Alteplase use in occluded central venous catheters in hemodialysis patients. *Anne M. Baciewicz, Pharm.D., M.B.A.*; University Hospitals of Cleveland, Cleveland, OH.

PURPOSE: This prospective review assessed alteplase use in occluded central venous catheters (CVCs) in adult hemodialysis patients to determine: 1) if 1 mg/ml per each occluded port was an efficacious dose to open the CVC; and 2) the types and incidence of adverse drug effects associated with alteplase.
METHODS: Eight hemodialysis nurses collected data on 50 hemodialysis patients from University Hospitals and Cleveland Dialysis Centers who met eligibility criteria from March 13 to October 6, 2000. Data collected included demographic information, catheter type, number of lumens occluded, alteplase dose, dwell times, concurrent anticoagulant/antiplatelet therapy, clinical outcomes, and adverse effects.
RESULTS: The fifty patients had 184 assessments completed in seven months. Thirty-six patients (72%) had permanent catheters with 100% being double lumen. Forty-nine patients (98%) had both catheter ports occluded. Catheter location was internal jugular (44%), subclavian (34%), external jugular (6%), and femoral (16%). Before alteplase instillation, the catheter could be flushed with no blood return in 33 patients (66%). The assessment after the initial alteplase dose showed that 33 patients (66%) cleared the occlusion after a dwell time of 30 minutes, Additional final dwell times of 60 minutes, 90 minutes, or overnight cleared the catheters of nine patients (18%), two patients (4%) and four patients (8%), respectively. No adverse effects were noted in any patient.
CONCLUSION: An alteplase dose of 1 mg/ml per occluded port (2 mg per double lumen catheter) is effective in opening occluded CVCs. Select patients will require maintenance alteplase to preserve the efficacy of their hemodialysis catheters.

Herbal Medicine

43. Evaluation of the use of complementary alternative medicine in the largest Mexican-American border city. *José O. Rivera, Pharm.D.,* Mark Lawson, M.D., Kalpama Verma, M.D.; University of Texas at El Paso, El Paso, TX; University of Texas at Austin, Austin, TX; Texas Tech University Health Sciences Center; Austin, TX.

PURPOSE: To evaluate the use of complementary alternative medicine (CAM) in the El Paso region (El Paso, Texas, and Las Cruces, New Mexico).
METHODS: This is a prospective study of patients who visited hospitals and clinics throughout the El Paso region. Only participants older than 18 years of age were included and each received a $5 compensation fee. A 12-page bilingual questionnaire was used to assess the use of CAM during the previous 12-month period. The study was conducted between April and October of 2000.
RESULTS: A total of 426 participants were included in the study. Sixty-three percent were females and 37% were males. Eighty-one percent of the participants were Hispanic. Forty-six percent obtained medications in Mexico. Forty-eight percent had an annual household income of less than $20,000. The mean age was 37.8 years (SD = 14.9) and the mean level of education was 12.5 years (SD = 4). The most common CAM providers were massage therapy or "sobador" (17.6%), herbalist or "yerbero" (12.4%), chiropractor (10.1%), acupuncturist (7.3%), and naturalist (6.6%). Other important CAM treatments were ceremonial sweeping (2.8%), "curandero" (2.8%), and urine therapy (0.7%). The most common herbal remedies were chamomile (27.4%), aloe vera (18.9%), peppermint (17.7%), and garlic (16.7%). Other herbs included cactus or "nopal" (7.0%), mullein (7.0%), wormwood (6.4%), eucalyptus (5.9%), chaparral (3.3%), rue (3.1%), and ginger (1.7%). Two participants indicated using a lead-based product to treat a condition known as "empacho". The most common nutritional or commercial products were vitamin products cited 780 times, echinacea (5.9%), St. John's wort (3.8%), chromium (2.4%), creatine (2.4%), cat's claw (2.1%), glucosamide (2.1%), ginger (2.1%), ginseng (2.1%), and *Ginkgo biloba* (1.7%). Other products used included mahuang (0.9%), dihydroepiandrosterone (0.5%), and kava kava (0.5%).
CONCLUSIONS: A wide range of CAM was documented in this study. Many of these therapies can have significant effects on different disease states and drug therapies, including undesirable effects. When performing drug histories, it is extremely important to ask patients about the use of CAM.

44. Comparative hemostatic effects of hydrophilic, alcohol, and lipophilic extractions of notoginseng. *C. Michael White, Pharm.D.,* Chengde Fan, M.S.,

Jessica Song, Pharm.D., James P. Tsikouris, Pharm.D., Moses Chow, Pharm.D.; University of Connecticut, Storrs, CT; Hartford Hospital, Hartford, CT; Chinese University of Hong Kong, Hong Kong.

PURPOSE: In a previous study, we found that externally administered notoginseng exhibits a hemostatic effect. Our current project compared the hemostatic effects of a hydrophilic, alcohol, or lipophilic extract of notoginseng to control and placebo using the same hemorrhagic model.
METHODS: Rats (n=62) were divided into five groups and their tails transected 5 mm from the tip. Group one received no treatment (control); group two received placebo (wheat flour); group three received the alcohol extract; group four received the hydrophilic (water) extract; and group five received the lipophilic (hexane) extract. The total bleeding time was determined and compared among the groups.
RESULTS: The data are presented in the table and bleeding time is expressed in minutes.

Control (n=15)	Placebo (n=17)	Alcohol (n=10)	Hydrophilic (n=10)	Lipophilic (n=10)
17.55 ± 4.46	13.67 ± 3.14*	8.44 ± 1.23*†‡	11.60 ± 3.93*	15.82 ± 9.9

ANOVA p<0.0001; *p<0.05 vs control; †p<0.05 vs placebo; ‡p<0.05 vs lipophilic

CONCLUSIONS: The alcohol extract of notoginseng has the shortest bleeding time and provides better hemostatic effects than no treatment, placebo treatment, and treatment with the lipophilic extract of notoginseng. Wheat flour (placebo) provides a hemostatic effect vs no treatment.

45. Use of complementary medications by patients attending a family practice clinic. Jeffrey Cavaness, M.D., *Rex W. Force, Pharm.D., FCCP, BCPS*; Idaho State University, Pocatello, ID.

PURPOSE: To determine the characteristics of complementary medication (CM) use among patients attending a family practice clinic (FPC).
METHODS: A survey was used to collect demographic data and information pertaining to CM use from consecutive patients attending FPCs. The survey included questions about perceived benefits of CM and patient willingness to discuss CM use with their physicians or pharmacists. A random chart review was performed during the survey period to investigate documentation of CM use. Data were analyzed with SPSS.
RESULTS: Of the 247 surveys distributed, 198 were completed. The mean age of the respondents was 45 (± 17) years; 61.8% were female. Forty-six percent of respondents stated that they used CM, spending a mean of $29.13 (± $30.32) monthly. Magnesium (17.5% of users), garlic (17.5%), gingko (17.5%), echinacea (11.3%), and chamomile (11.3%) were the most commonly used products. Benefits were perceived by 68.5% of users. Side effects attributed to any CM were noted by 12% of users. Friends and family were most likely to influence CM use. In 19.1% and 14.3%, respectively, physicians and pharmacists had recommended CM use. Of those who used CM, 35.6% had informed their physician and 17.7% had informed their pharmacist. 96.6% and 98.8%, respectively, would inform their physician and pharmacist if asked about CM use. Nearly 100% of patients wanted more information about CM from their physician or pharmacist. Only 5% of charts reviewed documented CM use.
CONCLUSIONS: Complementary medication use is common among patients attending an FPC. Communication between patients and providers about CM use needs improvement.

46. Impact of *Ginkgo biloba* on the pharmacokinetics of digoxin. *Vincent F. Mauro, Pharm.D., FCCP*, Laurie S. Mauro, Pharm.D., James F. Kleshinski, M.D., Paul W. Erhardt, Ph.D.; University of Toledo; Medical College of Ohio, Toledo, OH.

PURPOSE: This study was conducted to determine if a drug interaction exists between oral digoxin and a locally popular ginkgo biloba product.
METHODS: The study was a randomized, open-labeled, crossover trial. Healthy subjects received either 0.5 mg oral digoxin alone (D) or following 7 days of ginkgo leaf extract (*Ginkgo biloba*) 80 mg TID (D+G). During each phase, immediately before digoxin ingestion and on eight occasions over 36 hours afterwards, blood was collected from the volunteers for serum digoxin concentration determination. Digoxin concentrations were measured using a fluorescence polarization immunoassay. The mean values of C_{max}, T_{max}, AUC, and k_e were compared using the Student's paired t-test. Given the fact that the composition of ginkgo biloba products can vary among manufacturers, the chemical constituents of the product used in this investigation were fingerprinted by HPLC so that the results of this trial could be better compared with future investigations.
RESULTS: Eight healthy subjects were entered into the trial (seven males) after informed consent was obtained. The pharmacokinetic results (± SD) are:

	D	D + G
C_{max} (ng/mL)	1.6 ± 0.3	1.4 ± 0.5
T_{max} (hour)	1.4 ± 0.6	1.3 ± 0.5
$AUC_{0-\infty}$ (ng/ml·h)	21.0 ± 8.6	27.0 ± 12.8
k_e (h^{-1})	0.030 ± 0.022	0.017 ± 0.012

A significant statistical difference was not observed in any of the results.

CONCLUSION: A locally popular ginkgo biloba product did not appear to have any effect on the pharmacokinetics of oral D in healthy volunteers.

HIV/AIDS

47. The proteinase inhibitor-sparing compact quad regimen of Combivir®/abacavir/efavirenz is potent and well-tolerated in naive subjects with high viral loads: 24-week data. *P. Ruane*, D. Parenti, S. Hessenthaler, D. Shepp, D. Spragion, J. Tolson, L. Yau, M. St. Clair, D. Goodwin; Tower ID, Los Angeles, CA; George Washington University, Washington, DC; Glaxo Wellcome, Research Triangle Park, NC; North Shore University Hospital, Manhassett, NY.

BACKGROUND: Proteinase inhibitor-containing highly active antiretroviral therapy regimens provide significant virologic, immunologic, and clinical benefits for HIV-infected patients, but their utility is often limited by adverse effects and adherence challenges. The potent, BID compact quad regimen of Combivir® (COM), abacavir (ABC), efavirenz (EFV) merits further clinical study in naive subjects.
METHODS: This 48-week, prospective, open-label trial is being conducted to study the efficacy, safety, and adherence achieved with COM 1 tab BID, ABC 300 mg BID and EFV 600 mg QD in ART-naive adult subjects (confirmed by genotype) with HIV RNA (vRNA) ≥ 1000 c/ml. Enrollment continues in this study (27/40 enrolled); data from a planned interim analysis are presented for the first 15 subjects to reach week 24.
RESULTS: Of these 15 subjects, 87% are male and 53% are Caucasian, with a mean age of 41 years. Median baseline (BL) vRNA was 5.2 $\log_{10}$ c/ml by PCR (87% had vRNA > 5.0 logs); median CD_4 count was 278/mm^3. Median change in vRNA from baseline to week 24 was –3.5 logs. By ITT, M=F analysis, 93% of subjects achieved vRNA < 400 c/ml, and 80% achieved < 50 c/ml at week 24. As-treated results indicated 100% of subjects with vRNA < 400 c/ml and 86% < 50 c/ml. As-treated ultra-boosted assay results show that among subjects with vRNA < 50 c/ml at week 24, 8/12 had vRNA < 3 c/ml. Median change in CD_4 count from BL to week 24 was 101/mm^3 (ITT). Median T-cell receptor excision circles (TRECs)/100,000 PBLs increased from 284 at BL to 1027.5 at week 24, indicating an increase in naive T-cells. The quad regimen was well-tolerated; no SAEs or ABC hypersensitivity reactions were reported. At weeks 2 and 24, 86% and 92% of subjects, respectively, reported 100% adherence to all study drugs over the past week.
CONCLUSIONS: In this high vRNA naive population, the compact quad regimen of COM/ABC/EFV is potent, well-tolerated and patient-friendly.

48. Rapid rise in serum lipid profiles after initiation of ritonavir/indinavir combination in HIV patients. *Alice K. Pau, Pharm.D.*, JoAnn Mican, M.D., Susan Vogel, BSN; NIH Clinical Center, Bethesda, MD.

PURPOSE: Addition of low-dose ritonavir (RTV) to indinavir (IDV) allows for BID dosing without food restriction. This strategy is widely used to improve adherence and as salvage antiretroviral therapy.
METHOD: A retrospective chart review of RTV/IDV's effect on lipid profiles was undertaken after the discovery of drastic rises in serum lipids in two patients (to low-density lipoprotein [LDL] 300 and 350 mg/dl, total cholesterol 590 and 943, triglycerides 4127 and 5910) 1–2 months after starting RTV/IDV.
RESULTS: Forty-four patients were prescribed RTV/IDV (21 as salvage, 23 for adherence) for a mean duration of 8.2 months. Forty-two (95.5%) patients were protease inhibitor (PI)-experienced (mean=33.8 months): 39 (93%) IDV-experienced, 12 (28.6%) RTV-experienced. Seven (16%) patients were receiving statins before RTV/IDV. Pre-RTV/IDV, LDL was < 130 (low cardiac risk) in 26 (59%) and > 159 (high cardiac risk) in 7 (16%) patients. After 2.8 months of RTV/IDV, 17 of 37 (45.9%) patients with baseline LDL < 160 rose to > 160 (mean 127.4–192.7). Of the seven patients with baseline LDL > 160, further increases occurred after RTV/IDV initiation (mean 195.5–232.3). Total cholesterol and triglycerides were also increased. Because of the lipid abnormalities, three patients were switched to PI-sparing regimens, one underwent treatment interruption, and statins were initiated in three patients.
CONCLUSION: RTV/IDV resulted in rapid increase in LDL shortly after therapy initiation in > 50% of the patients, necessitated treatment interventions in seven (16%) patients. Though the long-term cardiovascular risks of PI-associated hyperlipidemia is unknown, it is prudent to monitor lipid profiles every 2–3 months after RTV/IDV initiation.

49. Lipid profiles and treatment for hyperlipidemia in HIV-positive patients. *Marisel Segarra-Newnham, Pharm.D., BCPS*, Bryan D. Volpp, M.D.; VA Medical Center, West Palm Beach, FL.

BACKGROUND: Treatment with protease inhibitors (PI) as part of an antiretroviral (ARV) regimen has been associated with lipid abnormalities in HIV-infected patients.
PURPOSE: A retrospective review was conducted to assess the frequency of lipid abnormalities and treatment for patients followed at a Veterans Affairs clinic.
METHODS: All patients followed for at least 3 months were eligible for

review. Data collected included: age, latest CD_4 cell count and viral load (VL), ARV history and all total cholesterol (CH), triglyceride (TG), and high-density lipoprotein (HDL) and low-density lipoprotein (LDL) values. Antiretroviral therapy at the time of lipid readings was classified as including protease inhibitors (PI+) or not (PI-). Lipid values were compared to goals per national guidelines according to risk factors.
RESULTS: One hundred one patients (all men) providing 266 lipid profiles were evaluated (median two per patient). Mean age was 51. Median CD_4 and VL were 344 and 7837, respectively. Twenty-eight patients had VL < 50. Fourteen patients had diabetes, 32 had hypertension, and nine had documented coronary disease. Mean CH, TG, and LDL were significantly higher in PI+ compared to PI- patients (207 vs 188; 286 vs 206; 124 vs 112; p<0.03). High-density lipoprotein values were not different (43 vs 44). Significantly more PI+ patients had lipid levels above recommended goals compared to PI- patients (19 vs 8; p=0.02). Six patients achieved lipid goals after low-fat diet (four PI+). Fifteen patients (11 PI+) were being treated with medications (11 simvastatin; 1 gemfibrozil; 1 atorvastatin/gemfibrozil; 2 simvastatin/gemfibrozil). Ten patients (67%) had reached lipid goals (mean 22% CH decrease), two patients had not reached goals (13%) and three patients (20%) were having medication therapy titrated at time of evaluation. Five patients (three PI+) were not receiving treatment for hyperlipidemia and are being scheduled to see the clinical pharmacy specialist in the clinic. In addition, one patient (PI+) declined therapy.
CONCLUSIONS: Our HIV-infected patients had significantly higher CH, TG, and LDL values if PI+. In contrast to other reports, the majority of patients treated for lipid abnormalities achieved goals.

Infectious Diseases

50. Characterizing clinical outcomes in patients with *Streptococcus pneumoniae* based on penicillin susceptibility. *Naomi R. Florea*, George S. Jaresko, Pharm.D., Victoria Zarotsky, Pharm.D., Maria D. Appleman, Ph.D., C. Thomas Boylen, M.D.; University of Southern California, Los Angeles, CA.

PURPOSE: To characterize clinical outcomes in patients with *Streptococcus pneumoniae* (SP) based on penicillin (PCN) susceptibility.
METHODS: Two hundred fifty-five patients with culture confirmed SP between January 1998 and August 1999 were identified. Patients were excluded if they were < 18 years old, did not require hospital admission, or had incomplete charts. Patients were grouped according to PCN susceptibility: susceptible (PSSP), intermediately resistant (PISP), highly resistant (PRSP), and nonsusceptible (PNSSP=PISP+PRSP). Forty-three demographic and clinical variables (e.g., age, total length of hospitalization [LOS-T], length of hospitalization due to SP infection [LOS-I], modified Fine's severity of illness score, gender, HIV status, mortality, ethnicity, culture site, pneumonia diagnosis, ICU admission) were identified to be extracted from the patient charts. Analysis using univariate methods were applied to evaluate outcomes comparing patient groups stratified by PCN susceptibility.
RESULTS: Of the 255 patients identified, 89 met the inclusion and exclusion criteria: 52 PSSP and 37 PNSSP (21 PISP, 16 PRSP). 40.4% and 38.2% were Hispanic and African-American patients, respectively; 43.5% of patients were ICU admits. In patients requiring emergent intubation, it was more common to identify PRSP from endotracheal (ET) sites (9/16 PRSP ET; 56%; p=0.02). PRSP was associated with a greater LOS-I (median 3.0 vs 1.5 vs 6.5 days; p=0.009). When comparing Fine's score in PSSP and PNSSP patients, we found a median score of 79 and 83, respectively (p=0.06). There was no statistical difference in age, LOS-T, gender, HIV status, mortality, ethnicity, pneumonia diagnosis, and ICU admission among the groups tested.
CONCLUSIONS: PRSP was associated with a greater proportion of patients with respiratory failure. Patients with PRSP infection had a longer length of hospitalization due to infection. Patients with PNSSP trended towards an increased Fine's score.

51. Effect of protein binding and in vitro activity of FK-463. *Erika J. Ernst, Pharm.D.*, C. Rosemarie Petzold, B.S., Ellen E. Roling, B.S., Douglas J. Keele, B.S., Michael E. Klepser, Pharm.D.; University of Iowa, Iowa City, IA.

PURPOSE: To characterize the activity of the new echinocandin antifungal agent FK-463 using microdilution and time-kill methods. Because FK-463 is greater than 90% protein bound, we also sought to determine the impact of protein binding on the in vitro activity.
METHODS: Approved techniques for microdilution minimum inhibitory concentration (MIC) testing were adapted and applied to FK-463. Ten candida isolates, including four species, were selected for testing. Doubling dilutions of FK-463 were tested at concentrations ranging from 0.0039 to 4 µg/ml. The MIC was read after 48 hours of incubation, as the concentration resulting in 80% inhibition and 100% inhibition compared to control wells containing no antifungal. MICs also were conducted with the addition of 10%, 20%, and 50% human serum and plasma to determine the effect of protein binding on the MIC. All MICs were performed in triplicate. Time-kill studies were conducted in RPMI media buffered with MOPS at concentrations ranging from 0.125 to 16 x MIC. Samples for colony counting were removed at 2, 4, 8, 12, and 24 hours after the addition of antifungal. Time-kill studies were conducted in duplicate.
RESULTS: Minimum inhibitory concentrations ranged from 0.0039 to 0.25 µg/ml for all ten isolates. All *C. albicans* isolates had MIC values ≤ 0.0156 µg/ml, whereas *C. krusei* had MIC values of 0.25 µg/ml. Overall the addition of serum or plasma increased the MIC 6–7-fold for *C. albicans* and 3–4-fold for *C. krusei* and *C. tropicalis*. Time-kill studies demonstrate FK-463 is fungicidal (≥ 99.9% reduction in CFU/ml) at concentrations approximately 4–16 x MIC. FK-463 was fungicidal against all isolates except one *C. albicans* isolate and two *C. tropicalis* isolates.
CONCLUSIONS: FK is a very potent antifungal agent against a variety of candida species, producing fungicidal activity in seven of ten isolates tested. The MIC is influenced by the addition of serum or plasma, indicating the high degree of protein binding may affect activity.

52. In vitro activity of moxifloxacin against isolates of *Streptococcus pneumoniae* possessing *parC* and *parC/gyrA* mutations. *Holly L. Hoffman, Pharm.D.*, Michael E. Klepser, Pharm.D., Erika J. Ernst, Pharm.D., Gary V. Doern, Ph.D.; University of Iowa, Iowa City, IA.

PURPOSE: To evaluate the bactericidal activity and the effect on MICs that occur among *Streptococcus pneumoniae* (SPN) isolates with documented *parC* and *parC/gyrA* mutations following exposure to moxifloxacin.
METHODS: We used a 2 L one-compartment in vitro model to simulate moxifloxacin total drug pharmacokinetics ($AUC_{0\text{-}24}$ = 48 µg•hr/ml, $t_{1/2}$ = 12 hours, C_{max} = 3.2 µg/ml). Eight SPN isolates, four *parC* and four *parC/gyrA* containing isolates, were evaluated. SPN MICs were 0.25 µg/ml and 2-4 µg/ml for *parC* and *parC/gyrA* containing isolates, respectively. Three moxifloxacin dosage regimens and a control were studied: 1/10x AUC, 1x AUC, and 10x AUC. Moxifloxacin was administered at 0 and 24 hours. Samples were aseptically obtained at predetermined timepoints (0, 2, 6, 12, 24, 28, and 48 hours) and plated on blood agar plates (BAP) for colony count determination. At 24 and 48 hours samples were plated on moxifloxacin containing BAP (4x the MIC).
RESULTS: In isolates possessing *parC* mutations, moxifloxacin resulted in a mean $\log_{10}$ CFU/ml decrease of 2.63 (± 0.87) and 4.34 (± 0.64) at 48 hours with 1x and 10x AUC regimens, respectively. Isolates with *parC/gyrA* mutations had a mean increase of 0.94 (± 1.26) and decrease of 1.89 (± 1.36), respectively. Growth was observed on moxifloxacin-containing BAPs for 1/10x and 1x AUC. Control and 10x AUC regimens did not select resistant isolates.
CONCLUSIONS: Moxifloxacin retained bacteriostatic and bactericidal activity against SPN isolates with *parC* mutations with 1x and 10x AUC regimens, respectively. Exposure of *parC* containing isolates to suboptimal concentrations results in the selection of SPN isolates with reduced susceptibility to moxifloxacin.

53. Effect of MIC methodology on AUC/MIC calculations for fluoroquinolones vs *Streptococcus pneumoniae*. Melissa A. Graff, Pharm.D. candidate, *Michael B. Kays, Pharm.D.*; Purdue University, Indianapolis, IN.

PURPOSE: To evaluate the effect of MIC methodology (E-test and broth microdilution) on the pharmacodynamics ($AUC_{0\text{-}24}$/MIC) of four fluoroquinolones vs *Streptococcus pneumoniae*.
METHODS: One hundred nonduplicate clinical isolates of *S. pneumoniae* (30 penicillin-susceptible, 30 penicillin-intermediate, 40 penicillin-resistant) were studied. MICs were determined by E-test and broth microdilution (NCCLS) for levofloxacin, gatifloxacin, moxifloxacin, and gemifloxacin. Using pharmacokinetic variables from published studies and abstracts in normal volunteers, serum concentration-time profiles were simulated for the following oral regimens: levofloxacin 500 mg q24h; gatifloxacin 400 mg q24h; moxifloxacin 400 mg q24h; gemifloxacin 320 mg q24h. All simulated concentrations were corrected for protein binding, and free $AUC_{0\text{-}24}$ were calculated by the trapezoidal rule. $AUC_{0\text{-}24}$/MIC ratios were calculated using the MICs determined by E-test and broth microdilution methods. $AUC_{0\text{-}24}/MIC_{50}$, $AUC_{0\text{-}24}/MIC_{90}$, and average $AUC_{0\text{-}24}$/MIC ratios were calculated for each regimen. Differences in MICs (after logarithmic transformation) and $AUC_{0\text{-}24}$/MIC ratios based on MIC methodology were determined using the paired t-test (level of significance, p<0.05).
RESULTS: Broth microdilution MICs for levofloxacin, gatifloxacin, moxifloxacin, and gemifloxacin were significantly lower than E-test MICs (p<0.0001). As a result, $AUC_{0\text{-}24}$/MIC ratios were significantly higher for each regimen when the MICs were determined by broth microdilution as compared to E-test (p<0.0001).
CONCLUSIONS: There is a significant difference in fluoroquinolone MIC results obtained by E-test and broth microdilution methodologies for *S. pneumoniae*. When evaluating fluoroquinolone pharmacodynamics vs *S. pneumoniae*, clinicians must be aware that MIC testing methodology may have a significant impact on the results.

54. Characterization of the in vitro activities of linezolid, oritavancin, levofloxacin and vancomycin against vancomycin-tolerant *Streptococcus pneumoniae*. *Raymond Cha, Pharm.D.*, Michael J. Rybak, Pharm.D., FCCP; Anti-infective Research Laboratory; Wayne State University; Detroit Receiving Hospital/University Health Center, Detroit, MI.

PURPOSE: Vancomycin tolerance in a multidrug-resistant *Streptococcus pneumoniae* strain has recently emerged (Nature 1999;399:590-3). Limited antimicrobial options for this pathogen in conjunction with the suggestion of tolerance as a precursor for resistance is cause for concern. Possible alternatives include extended spectrum fluoroquinolones and novel classes of antimicrobial agents such as lipopeptides and semisynthetic glycopeptides.
METHODS: Vancomycin-tolerant *Streptococcus pneumoniae* (VTSP) strain P9802-020 was used for kill curve analyses. Minimum inhibitory concentrations (MICs) were determined by broth microdilution and confirmed by the E-test method. Minimum bactericidal concentrations (MBCs) were performed according to NCCLS guidelines. Bacterial density-time profiles of VTSP over 24 hours were created for drug exposures at multiples of the MIC: 4, 10, and 20 times the MIC for linezolid and vancomycin; 4 and 10 times the MIC for levofloxacin; and 4 times the MIC for oritavancin.
RESULTS: The MIC/MBC for linezolid, oritavancin, levofloxacin, and vancomycin were 0.5/2, 0.03/0.06, 0.5/0.5, and 0.5/1 µg/ml, respectively. Although none of the vancomycin study arms achieved greater than 99% kill ($k > 99$), linezolid at 10 and 20 times the MIC achieved $k > 99$ with time to $k > 99$ ($t > 99$) occurring at 24 hours. Oritavancin at 4 and levofloxacin at 4 and 10 times the MIC achieved $k > 99$ with $t > 99$ occurring at 2, 6, and 4 hours, respectively.
CONCLUSIONS: Vancomycin tolerance appears to be more accurately characterized by kill curve analyses than MBC:MIC ratios. Linezolid, oritavancin, and levofloxacin appear to provide adequate activity against VTSP.

55. Comparative analysis of the mutant prevention concentration for fluoroquinolones against *Staphylococcus aureus* and *Streptococcus pneumoniae*. *George P. Allen, Pharm.D.,* Michael J. Rybak, Pharm.D., FCCP; Anti-Infective Research Laboratory; Wayne State University; Detroit Receiving Hospital/University Health Center, Detroit, MI.

PURPOSE: The mutant prevention concentration (MPC) is a novel method for evaluating fluoroquinolone potency. The MPC, defined as the minimum inhibitory concentration (MIC) of the most resistant first-step mutant of a heterogeneous population, is determined using a much higher inoculum than the MIC. Thus, the MPC may be a more reliable indicator of antimicrobial activity and prevention of resistance. The relationship between MPC and MIC or MBC, however, is unclear. We determined MPCs for *Staphylococcus aureus* (SA) and *Streptococcus pneumoniae* (SP) for a variety of fluoroquinolones and quantified the relationship between MPC and MIC/MBC.
METHODS: Mutant prevention concentrations were determined for ciprofloxacin, gatifloxacin, gemifloxacin, levofloxacin, and moxifloxacin by plating an inoculum ~$10^{10\text{-}11}$ on antibiotic-containing agar, with the MPC defined as the lowest concentration inhibiting growth. Minimum inhibitory concentration and MBCs were performed using microdilution (inoculum ~$10^{5\text{-}6}$). Relationships between MPC and MIC or MBC were calculated using multivariate regression.
RESULTS: Mutant prevention concentrations ranged from 0.06–2 mg/L (MICs 0.03–0.125 mg/L) and 0.5–8 mg/L (MICs 0.03–1 mg/L) for SA and SP, respectively. The rank order of MPCs was gemifloxacin ≤ moxifloxacin ≤ gatifloxacin < levofloxacin < ciprofloxacin. Significant correlation between MIC or MBC and MPC was noted when all organisms were analyzed. Stepwise analysis revealed a significant correlation for SA, but not SP.
CONCLUSIONS: Our data demonstrate that the MPC may not be predictable based on MIC or MBC. Although significant correlation was noted for SA, results for SP failed to demonstrate a consistent correlation between MPC and MIC/MBC. Further study is necessary to quantify the relationship between the MPC and standard measures of antimicrobial activity.

56. E-testing for the determination of MICs for selected fluoroquinolones against *Pseudomonas aeruginosa* and *Streptococcus pneumoniae*. *Eric G. Sahloff, Pharm.D.,* Ben Smith, B.S., Steven J. Martin, Pharm.D.; University of Toledo, Toledo, OH.

PURPOSE: Newer fluoroquinolones (FQ) are now commonly used against antibiotic-resistant *Streptococcus pneumoniae* (SP) and *Pseudomonas aeruginosa* (PA) infections. MIC testing with the E-test has become routine in clinical labs for FQ susceptibility testing against these organisms. However, E-testing is not an approved NCCLS testing method, and has not been validated for FQ against SP and PA using a gold standard MIC testing method.
METHODS: We compared ciprofloxacin (C), levofloxacin (L), gatifloxacin (G), and moxifloxacin (M) MICs obtained with the E-test against agar dilution (gold standard) MICs for 30 SP and 62 PA clinical isolates. Results were considered the same if they were ± 1 $\log_2$ dilution.
RESULTS: The percentage of E-test MICs within x $\log_2$ dilutions of agar-dilution MICs were:

P. aeruginosa

Drug	-2	-1	Equal	+1	+2	% ± 1 $\log_2$
Ciprofloxacin	36	42	7	5		54
Levofloxacin	5	29	32	26	8	87
Gatifloxacin	24	62	7	7		76
Moxifloxacin	24	61	8	5		74

S. pneumoniae

Drug	-2	-1	Equal	+1	+2	% ± 1 $\log_2$
Ciprofloxacin		33	47	17	3	97
Levofloxacin	19	55	19		6	74
Gatifloxacin	10	74	13	3		90
Moxifloxacin	3	40	13	40	7	93

CONCLUSION: Agreement between E-test MICs and agar dilution MICs was ≥ 90% for C, G, and M against SP, but significantly lower for these agents against PA. Ninety-four percent of MICs fell within 1.5 $\log_2$ dilutions for all drugs against both organisms. Overall, lower MICs were obtained using the E-test. E-testing is a simple and reasonably accurate tool for approximating FQ MICs against SP, but may overestimate drug activity against PA, which could inappropriately suggest clinical effectiveness for these agents. Clinicians should be aware of their institution's susceptibility testing methods and these method's limitations.

57. Stability of antimicrobial sensitivity patterns in a high fluoroquinolone use environment. *Angela M. Swerlein, Pharm.D.,* Kathy A. Morman, Pharm.D., Mark A. Friedman, B.S.; Grant/Riverside Methodist Hospital, Columbus, OH.

PURPOSE: Limited data are available to describe the effect of high fluoroquinolone usage on resistance patterns in an institution. Additionally, clinical data describing its usefulness in Gram-negative nosocomial infections are sparse. The efficacy and effect of high-volume use of fluoroquinolones in a large teaching institution was studied.
METHODS: Ofloxacin became the sole fluoroquinolone on formulary in July 1995 and was later replaced by levofloxacin in November 1997. Susceptibility patterns for ciprofloxacin and ofloxacin/levofloxacin for fiscal year 1996 and fiscal year 2001 were quantified as percentage susceptible (dilution method). Institution fluoroquinolone usage has increased steadily throughout the past decade. Antibiotics commonly used to treat Gram-negative infections were assessed to determine selection pressure. Intensive care unit patients on levofloxacin were evaluated during a 6-week period. Empiric vs therapeutic use, clinical cure/failure rate, organisms isolated, treatment duration, ICU/hospital LOS, APACHE II score, and mortality were evaluated.
RESULTS: Based on antibiotic days, levofloxacin accounts for 41.3% of total antibiotic use compared to antibiotics selected for Gram-negative infections. Despite increased usage, sensitivities of Gram-negative organisms have been comparable and stable for the fluoroquinolones during the 5 years evaluated. In ICU patients, Gram-negative organisms were isolated most commonly (92%). Based on criteria, therapeutic success was achieved in 77% of cases (72% community acquired, 82.8% nosocomial infections).
CONCLUSIONS: Fluoroquinolones have historically maintained stable sensitivities in Gram-negative infections and continue to have a valuable role in the treatment of community-acquired and nosocomial infections even with unrestricted use.

58. Incidence of *Clostridium difficile*-associated diarrhea in patients treated with cefotaxime or levofloxacin for suspected community-acquired pneumonia or lower respiratory tract infection. *Lily Spasic, M.S.,* André Bonnici, M.S., Hélène Paradis, M.S.; Université de Montréal; Montreal General Hospital, Montréal, QC, Canada.

PURPOSE: This study documented the incidence of *Clostridium difficile*-associated diarrhea (CDAD) in patients treated with cefotaxime or levofloxacin for suspected community-acquired pneumonia (CAP) or lower respiratory tract infection on an internal medicine ward, while also assessing treatment days, treatment failure, the use of other antibiotics, length of stay, and mortality.
METHODS: The study was conducted by doing a retrospective chart review of patients admitted to the internal medicine wards from February 1, 1999, to March 31, 1999, for the cefotaxime group and from March 1, 2000, to May 31, 2000, for the levofloxacin group.
RESULTS: From a total of 200 patients, the data of 134 patients were analyzed; 84 patients in the cefotaxime group and 50 patients in the levofloxacin group. Both groups were comparable at baseline except for lower incidence of cardiac disease and immunosuppression in the levofloxacin group, as well as being younger. Seventeen of the 84 (20%) evaluable patients in the cefotaxime group had CDAD, compared with one patient of the 50 (2%) evaluable patients in the levofloxacin group ($p=0.0027$). Secondary endpoints demonstrated a statistically significant difference in favor of the levofloxacin group vs the cefotaxime group for the use of other antibiotics (36% vs 55% respectively; $p=0.035$) and mortality (8% vs 23%, respectively; $p=0.029$). There was no difference for the other endpoints.
CONCLUSION: This study demonstrates a significant reduction in the incidence of CDAD when using levofloxacin for the treatment of suspected CAP and lower respiratory tract infection.

59. Relationships between antibiotic use and the rates of isolation and antibiotic susceptibility of Gram-positive bacteria. *Kevin A. Enzweiler, Pharm.D.,* Kurt R. Lorenz, Pharm.D., John A. Bosso, Pharm.D., Roger L. White, Pharm.D.; Anti-Infective Research Laboratory; Medical University of South Carolina, Charleston, SC.

PURPOSE: To characterize relationships between antibiotic use and susceptibility (S) rates of Gram-positive pathogens so that antibiotic use and formulary decisions can be optimized at our institution.
METHODS: We collected antibiotic usage (dose, number of daily doses, length of therapy) and S data (percentage susceptible [S]/intermediate [I]/resistant [R] for all nonurine isolates) from adult patients throughout our institution between January 1992 and December 1999. Data were collected on a quarterly basis (seven ICUs and the non-ICU areas from which total ICU and hospital-wide data were calculated) and annual totals calculated. Patient days per year was recorded and used to normalize drug usage data (grams/patient day). Thirty-six antibiotics were studied and included β-lactams (BL), macrolides (MC), fluoroquinolones (FQ), and other agents (e.g., TMP/SMX, vancomycin, clindamycin). Gram-positive bacteria considered included enterococci, *S. aureus* (methicillin-susceptible and -resistant), coagulase-negative staphylococci (CNS), and *S. pneumoniae*. Linear regression was used to assess the relationship between drug usage and the percentage of S. Only relationships that met the criteria of the percentage S ≥ 70 during the study period and $r^2 \geq 0.5$ were assessed with linear regression.
RESULTS: There were 60 relationships that met the criteria. Of these, 20 relationships had a negative slope; 65% had an increasing drug usage/decreasing S percentage (↑D and ↓S), 20% had decreasing drug usage/increasing S percentage (↓D and ↑S) whereas 15% had other types of relationships. These findings suggest a strong relationship among the amount of antibiotic used and S of some organisms. Negative slopes were most often found with CNS (ciprofloxacin, erythromycin, and oxacillin in most areas) and least often with *E. faecium*. The rank order (which accounted for the number of possible occurrences) of all negative slopes by drug class was: MC > FQ > BL. TMP/SMX had the most negative slopes of any individual agent.
CONCLUSIONS: This quantitative assessment using strict criteria of drug use/S relationships in our institution detected strong relationships which may warrant antibiotic control policy use.

60. Relationships between usage and susceptibility of anti-infectives at a tertiary teaching hospital. David S. Burgess, Pharm.D., *Eileen C. Dobbs-Hamilton, Pharm.D. candidate*; University of Texas, Austin, TX; University of Texas Health Science Center, San Antonio, TX.

PURPOSE: To evaluate the relationship between antibiotic usage and susceptibility at a tertiary teaching hospital.
METHODS: Yearly hospital antibiograms and inpatient anti-infective purchase records (grams and dollars) from 1988-1999 were collected. Patient days/year were obtained and used to normalize drug usage. Overall, 26 antibiotics (8 penicillins, 6 cephalosporins, 1 miscellaneous β-lactam, 2 fluoroquinolones, 3 aminoglycosides, 6 miscellaneous antimicrobials) were evaluated. A total of 13 organisms were evaluated which included 4 Gram-positive (*S. aureus*, coagulase-negative staphylococci, enterococcus, and *S. pneumoniae*) and 9 Gram-negative (*E. coli, K. pneumoniae, C. diversus, C. freundii, Enterobacter, H. influenzae, P. mirabilis, P. aeruginosa*, and *S. marcescens*). The relationship between normalized antimicrobial usage and susceptibility for all antimicrobials and organisms were assessed by simple linear regression. Only relationships with susceptibility ≥ 70% during the study and r≥0.7 were assessed.
RESULTS: Antibiotic usage and expenditures have increased dramatically despite a decrease in the number of patient admissions/year and patient days/year. The β-lactam/β-lactamase inhibitors have been the most widely used agents at our institution until 1999 when the fluoroquinolones became the most widely used class of anti-infectives. A total of 37 relationships met the criteria for assessment (24 negative slopes and 13 positive slopes). Overall, ceftazidime, cefotaxime, and ciprofloxacin usage were associated with 58% of the negative slopes. The β-lactam/β-lactamase inhibitors usage accounted for 54% of the positive slopes.
CONCLUSION: Relationships between antibiotic usage and susceptibility are important and need to be evaluated at individual institutions to help direct appropriate antibiotic formulary decisions.

61. In vitro activity of fluconazole, itraconazole, and amphotericin against candida bloodstream isolates over the past 5 years. David S. Burgess, Pharm.D., *K. Michelle Crawford, Pharm.D.*; University of Texas, Austin, TX; University of Texas Health Science Center, San Antonio, TX.

PURPOSE: Candida species are the fourth leading cause of nosocomial bloodstream infections, and are associated with a higher mortality rate than any bacterial bloodstream infection. The purpose of this study was to compare the in vitro activity of fluconazole (F), itraconazole (I), and amphotericin (A) against candida bloodstream isolates.
METHODS: All bloodstream isolates due to candida species between January 1995 and August 2000 were obtained from the clinical microbiology laboratory. In vitro susceptibility testing was performed according to the NCCLS guidelines (M27-A). The MIC_{50}, geometric mean MIC, and percentage resistant were calculated for each antifungal agent. For F and I, the NCCLS breakpoints were used to determine the percentage susceptible (MIC ≤ 8 and ≤ 0.13 µg/ml), susceptible dose-dependent (16-32 and 0.25-0.5 µg/ml), and resistant (≥ 128 and ≥ 1 µg/ml), respectively. For amphotericin, a MIC ≤ 1 µg/ml was defined as susceptible and > 1 µg/ml as resistant.
RESULTS: A total of 156 candida bloodstream isolates were evaluated, including 53 *C. albicans* (CA), 44 *C. glabrata* (CG), 28 *C. tropicalis* (CT), 23 *C. parapsilosis* (CP), 6 *C. krusei* (CK), and 2 *C. lusitaniae* (CL). No isolate of the same species from the same patient was included. No change in the MICs over time occurred for any of the antifungals against CA, CT, CP, CG. The MIC_{50}, geometric mean MIC, and percentage resistant were as follows: CP, 1, 0.83, 0% (F), 0.06, 0.05, 0% (I), 0.13, 0.11, 0% (A); CA, 1, 2.47, 21% (F), 0.13, 0.15, 26% (I) and 0.5, 0.37, and 6% (A); CT, 4, 5, 25% (F), 0.25, 0.38, and 36% (I), and 1, 0.91, 25% (A); CG, 8, 5.4, 7% (F), 1, 0.95, 57% (I), 1, 1.07, 32% (A).
CONCLUSIONS: A high percentage of candida isolates were resistant to each antifungal agent; however, no change in MICs occurred over time for fluconazole, itraconazole, or amphotericin against bloodstream isolates of candida species over the past 5 years at our institution. Further studies of the correlation between MICs of bloodstream infections and clinical outcomes are needed to determine the significance of these in vitro studies.

62E. Selection and costs of antibiotics for patients with a reported β-lactam allergy. *Eric J. MacLaughlin, Pharm.D.*, Joseph J. Saseen, Pharm.D., Daniel C. Malone, Ph.D.; Texas Tech, Amarillo, TX; University of Colorado, Denver, CO; University of Arizona, Tucson, AZ.

Published in Arch Fam Med 2000;9:722-6.

Nephrology

63E. Intracellular acidification during cisplatin-induced renal cell apoptosis. *Alan H. Lau, Pharm.D.*, Yi Yong Qiu, B.S., Cheng Jin Li, M.S., Jose A. Arruda, M.D.; University of Illinois at Chicago, Chicago, IL.

Published in J Am Soc Nephrol 1999;10:496A.

64. Use of an in vitro model with pharmacokinetic simulation to characterize drug disposition during hemodialysis. *Joanna Q. Hudson, Pharm.D.*, Thomas J. Comstock, Pharm.D.; University of Tennessee Health Science Center, Memphis, TN; Virginia Commonwealth University/MCV Campus, Richmond, VA.

PURPOSE: Drug removal during hemodialysis (HD) is variable and dependent on drug and dialysis characteristics. An in vitro dialysis system was developed to determine vancomycin (VANC) elimination and to perform simulations of in vivo drug disposition during HD using in vitro results.
METHODS: In vitro dialysis was performed using four different HD membranes, polymethylmethacrylate (PMMA; Toray BK-2.1 U), polysulfone (PS; Fresenius F-80), polyacrylonitrile (PAN; Cobe Filtral-20), and hemophan (HE; Cobe 700 HE). Dialysis was 2 hours, using a volume of 4.0 L NS and flow of 300 ml/minute to approximate a blood flow of 450 ml/minute based on Hct of 34%. Dialysate flow was 800 ml/minute. The initial VANC concentration was 30 mg/L. Clearance (CL_D) and intradialytic half-lives were determined using monoexponential regression of arterial concentrations during dialysis. Removal and rebound in HD patients were simulated using the in vitro CL_D and a two-compartment model with literature values (V_c 11.3 L, k_e 0.012 h^{-1}, k_{12} 1.11 h^{-1}, and k_{21} 0.189 h^{-1}; Schaedeli, Clin Pharm Ther 1998;63:26-38) and plasma protein binding of 30%. Simulations were based on a single 1-gram dose of VANC administered 44 hours before a 4-hour HD treatment.
RESULTS: In vitro and simulated results are as follows. The time of maximum VANC concentration post-dialysis was 4.0 hours. The short apparent half-life during dialysis reflects rapid elimination from central compartment.

Parameter	Polysulfone	PAN	PMMA	Hemophan
CL (in vitro) ml/minute	144.1	132.3	108.8	73.3
Simulation results				
CL (in vivo) ml/minute	100.9	92.7	73.5	51.2
Kd (hour-1)	0.536	0.492	0.39	0.272
% Removal	21.1	20	16.9	12.7
% Rebound	35.6	32.3	25.4	17.4
Half-life-HD (hour)	5.4	5.7	7.0	9.5

CONCLUSIONS: The simulated data are consistent with reported findings in patients undergoing HD (DeSoi, Am J Kidney Dis 1992;20:354-60 and Pollard, Kidney Int 1994;45:232-7). The observed discrepancy between the dialysis half-life and amount removed is consistent with redistribution kinetics during HD. This model may serve as a useful tool in drug development to assess the influence of HD on drug disposition.

Oncology

65. Financial and clinical outcomes of revised supportive care guidelines in pediatric bone marrow transplant patients. Helen T. Wu, Pharm.D., *Sharon L. Youmans, Pharm.D.*; University of California, San Francisco Medical Center, San Francisco, CA.

PURPOSE: At our institution intravenous immunoglobulin (IVIG) and intravenous fluconazole (IVFLU) are used routinely for infection prophylaxis in pediatric bone marrow transplant (PBMT) patients. The high expense of these agents mandates cost-effective use of these products. Programs associated with the cost-effective use of IVIG and IVFLU have not been described in PBMT. This investigation intends to document the financial and patient outcomes associated with the revised guidelines.
METHODS: Under the pre-existing guidelines, IVFLU 3 mg/kg/day was used as fungal prophylaxis, starting on the day of admission and continuing with oral FLU for 3–6 months post-transplantation. Patients also received IVIG 100 mg/kg/dose weekly throughout the transplant period. Under the revised guideline in June 1999, IVFLU started on the day of bone marrow transplantation and discontinued when the absolute neutrophil count reached ≥ 1000. Intravenous immunoglobulin 100 mg/kg/dose was to be given twice monthly, because to date there is no definitive data documenting the need for weekly IVIG. Cost savings and microbiological outcomes were evaluated.
RESULTS: A total of 70 patients were reviewed and compared (31 prior and 39 after revisions). Before the revision, 6/31 (20%) patients had a total of 11 positive blood cultures. After the revision, 9/39 patients (23%) had a total of 15 positive blood cultures. All positive blood cultures grew either Gram-positive or Gram-negative bacteria. No blood cultures were positive for fungus. The total cost savings was $34,000/year or $1000/patient/year.
CONCLUSION: The new usage guidelines for IVIG and FLU in PBMT at out institution provided significant cost savings with no increase in the incidence of bacteremia or fungemia.

66. Incidence of cancer-related fatigue and factors which may predict severity. *Jody B. Sheehan, Pharm.D.,* Val R. Adams, Pharm.D., George Davis, Pharm.D.; Markey Cancer Center; University of Kentucky, Lexington, KY.

PURPOSE: Cancer patients are subjected to many adverse effects that impair their quality of life. Cancer-related fatigue (CRF) is the most commonly reported symptom in patients who receive chemotherapy or local radiation with prevalence rates ranging from 60-96%. The introduction of validated surveys, such as the Brief Fatigue Inventory (BFI) scale, have increased research and clinical interest in studying CRF. The goal of our study is to report baseline fatigue data for patients treated at the Markey Cancer Center outpatient clinic and to determine factors that may predict fatigue severity. The primary purpose of this study is to determine the frequency with which patients treated at an ambulatory cancer clinic suffer from mild, moderate, or severe cancer-related fatigue as determined by the BFI scale.
METHODS: All patients receiving treatment at the Markey Cancer Center between November 1, 2000, and January 1, 2001, completed a BFI scale assessment and were categorized by fatigue severity. Additional information collected included tumor type and stage, treatment regimen and cycle, medication history, pain score, nutritional status, electrolytes and hematocrit, and sleep and depression assessment.
RESULTS: Fifty-eight patients have completed the survey to date: 15% reported no fatigue, 47% reported mild fatigue, 20% reported moderate fatigue, and 6% reported severe fatigue. Patients with fatigue also reported an increased frequency of insomnia, pain, and depression. Hematocrit count did not correlate with fatigue.
CONCLUSIONS: Ambulatory cancer patients experience a high incidence of fatigue as determined by the BFI scale. Final data to be presented in poster.

Pediatrics

67. Safety and efficacy of etanercept in children with juvenile arthritis. *Kimberly B. Tallian, Pharm.D.,* Tara Smith, M.A., Joy Brown, Michael Seid, M.D., James W. Varni, M.D., Ilona S. Szer, M.D.; Children's Hospital, San Diego, CA.

INTRODUCTION: Etanercept is a novel treatment option for refractory juvenile arthritis (JA), whereby the agent binds to soluble TNFα to block the inflammatory pathway by inhibiting receptor binding.
METHODS: We designed a study to determine the efficacy, safety, and impact of quality of life of etanercept in which all education was provided by a pharmacist who traveled to the home to introduce the drug to the family. Baseline and subsequent assessments included morning stiffness, joint count, CRP, physician global assessment of disease activity, and reduction in immunosuppressive drugs. Quality of life was assessed at baseline and at subsequent follow-up visits using the Peds QL™ plus Rheumatology Module completed by both patients and parents to determine improvement in health-related quality of life. To evaluate the role of the pharmacist as a team member, a satisfaction questionnaire was used.
RESULTS: Sixteen patients (mean age = 12.7 years) with systemic JA (n=9), poly JA (n=6), and psoriatic JA (n=1) were included. Etanercept was administered twice weekly at a mean dose of 0.40 ± 0.025 mg/kg/day for a mean of 9 months (SD = 6.21 months). All children improved in all parameters measured ($p<0.01$) within 1 month. All children continued to improve except two patients had flares but were continued on etanercept. Seven of ten children were able to eliminate corticosteroids ($p<0.01$), whereas three of ten have reduced the dose. Two of three children discontinued cyclosporine. All domains of quality of life statistically improved self-report (from mean of 76.62 to 83.52; $p<0.037$) and daily activity improved by parent proxy report (from mean of 70.42 to 90.83; $p<0.13$). All parents were highly satisfied with the role of the pharmacist on the multidisciplinary team. Adverse effects included swelling at the site of injection (n=2), facial flushing (n=1), facial rash (n=1), urinary tract infection (n=1), and leukopenia (n=2).
CONCLUSIONS: Etanercept is a well-tolerated agent for refractory JA.

Pharmacoeconomics/Managed Care/ Health Services Research

68. Economic benefits of optimizing angiotensin-converting enzyme inhibitor therapy in congestive heart failure: the REACT Study. *Jeffrey A. Johnson, Ph.D.,* Dean Eurich, BSP, Ross T. Tsuyuki, Pharm.D., M.S.; Institute of Health Economics, University of Alberta, Edmonton, AB, Canada; Regina Health District, Regina, AB, Canada.

BACKGROUND: The purpose of this study was to assess the economic impact of a patient-centered support program aimed at optimizing angiotensin-converting enzyme inhibitor (ACEI) therapy for patients with congestive heart failure (CHF).
METHODS: A randomized, controlled trial; patients were identified in hospital with a clinical diagnosis of CHF and randomized to usual care or intervention arms. Intervention involved an initial assessment and regular follow up for ACEI therapy for 6 months following discharge. Resource use (i.e., drug therapy, doctor visits, emergency department visits, and hospitalizations) was measured by self-report and confirmed with hospital and pharmacy records. Total and CHF-related costs were estimated using average prices from the perspective of a Canadian provincial health care system.
RESULTS: Preliminary results are based on about 80% of enrolled patients (137 intervention/131 usual care). In the 6 months following discharge, patients in the intervention group had a modest increase in drug costs ($14.78), which was offset by decreases in costs of CHF-related doctor visits (-$20.73), emergency department visits (-$18.91), and hospitalizations (-$1,899.63). The total number of hospital admissions did not differ between intervention and usual care patients; reduced costs were due to fewer CHF-related hospital admissions (0.31 vs 0.18 per patient) and shorter length of stay (LOS; 11.8 ± 9.7 vs 10.4 ± 6.8 days). The average LOS for non-CHF hospital admissions was also shorter for intervention (5.0 ± 4.3 days) than usual care (7.6 ± 6.4 days) patients.
CONCLUSIONS: A patient-centered support program aimed at optimizing ACEI therapy for CHF patients at time of discharge resulted in substantially reduced total and CHF-related costs due to reduced hospital expenditures in 6 months of follow up.

69. Comparing cost of hypnotic use among patients prescribed mirtazapine, citalopram, venlafaxine, or sertraline in a managed care setting. *Lionel A. Pinto, M.S.,* Stephanie W. Wang, Ph.D., Yang Shen, M.S., Douglas J Wiener, M.D.; Health Benchmarks, Inc., Woodland Hills, CA; Organon Inc., West Orange, NJ.

PURPOSE: A major side effect of many antidepressants is insomnia. We compared hypnotic use among patients who had prescriptions for the antidepressants citalopram, venlafaxine, mirtazapine, or sertraline to gain insight into this potential source of excess costs.
METHODS: Pharmacy claims indicative of hypnotic use were obtained from three major health plans for 3 months before and 6 months after index date (depression therapy start date). Patients were included in the study if they were 18 years or older, had at least one hypnotic prescription in the preindex period, had at least four prescriptions for antidepressant study medication (citalopram, venlafaxine, mirtazapine, and sertraline) in the postindex period, and were continuously eligible during the study period. Cost of hypnotic prescriptions at the end of 3 and 6 months after the index date were analyzed separately.
RESULTS: Average costs of hypnotic prescriptions in the 3-month preindex period for patients prescribed mirtazapine (n=79), citalopram (n=98), venlafaxine (n=91), and sertraline (n=320) were $49.47, $50.96, $57.39, and $45.20, respectively. Costs during the 3-month postindex period were $39.88, $48.65, $59.25, and $49.00, respectively. Multivariate regression analysis revealed that 3-month postindex cost/number of hypnotics were significantly lower for mirtazapine patients compared with patients on venlafaxine ($p=0.02/p=0.03$) and sertraline ($p=0.02/p=0.04$). Compared to other study medications, the 6-month postindex hypnotic cost was lower (but not statistically significant) for mirtazapine patients.
CONCLUSIONS: Managed care enrollees prescribed the antidepressant mirtazapine used fewer hypnotic medications, and had lower hypnotic prescription costs, compared with venlafaxine, citalopram, and sertraline. These results have both pharmacoeconomic and clinical relevance.

70. Cost effectiveness analysis of dual controller therapy (inhaled fluticasone propionate plus salmeterol) vs single controller therapy with

higher doses of inhaled corticosteroids in the treatment of patients with persistent asthma. *E. Anne Davis, Pharm.D., M.S.*, Amanda Emmett, M.S., J. Peggy Hastie, MPH, Brian W. Bowers, Pharm.D.; Glaxo Wellcome Inc., Research Triangle Park, NC.

PURPOSE: To determine if dual controller therapy with low-dose inhaled corticosteroid plus salmeterol (SFP; 88 µg fluticasone propionate plus 42 µg salmeterol) BID was more cost effective than single controller therapy with higher doses of inhaled corticosteroids (ICS; 220 µg fluticasone propionate or 368 µg beclomethasone dipropionate) BID.
METHODS: Data from four randomized, double-blind, double-dummy, parallel clinical trials were analyzed. There were 467 patients in the (SFP) group and 950 patients in the (ICS) group. Two efficacy parameters were evaluated: improvement in morning peak flow (PEF) and symptom-free days (SFDs) in the treatment period. Health care use data were collected during each asthma exacerbation. The analysis was based on direct costs in year 2000 dollars. Direct costs included costs of study drugs, emergency department visits, hospitalizations, treatment for drug-related adverse events, and rescue medication (albuterol). Drug costs were based on average wholesale price (AWP). Other health care costs were based on published data.
RESULTS: The SFP (69.4%) group had significantly higher ($p<0.001$) proportion of patients with a (≥ 15% increase in PEF from baseline) than the ICS (44.8%) group and percentage SFDs at endpoint (38.7% vs 23.0%, respectively). The cost effectiveness ratios were $5.92 for SFP and $7.51 for ICS per improvement in PEF and $10.61 for SFP and $14.63 for ICS for SFDs.
CONCLUSION: From a third-party payer's perspective, this analysis shows that combination therapy (fluticasone propionate plus salmeterol) is more cost-effective than higher doses of inhaled corticosteroids (fluticasone propionate or beclomethasone propionate) for treating persistent asthma.

71. Pharmacoeconomic analysis of proton-pump inhibitor therapy in gastroesophageal reflux disease: a meta-analytic approach. *Daniel E. Hilleman, Pharm.D.*, Pamela A. Foral, Pharm.D.; Creighton University, Omaha, NE.

PURPOSE: The objective of the present study was to conduct a meta-analysis of published studies with the four H_2-receptor antagonists (H_2RAs) and the four proton-pump inhibitors (PPIs) that are commercially available and indicated in managing endoscopically proven grade II to IV erosive or ulcerative esophagitis. A pharmacoeconomic analysis based on the meta-analysis results was conducted.
METHODS: Relevant articles were identified through MEDLINE and Embase literature searches using the Mesh terms gastroesophageal reflux, randomized controlled trials, cimetidine, famotidine, lansoprazole, nizatidine, omeprazole, pantoprazole, rabeprazole, and ranitidine. Studies included in the meta-analysis had to be in English, randomized, double-blind, included a placebo or active control, including patients with endoscopically proven grade II to IV erosive or ulcerative esophagitis, and treatment with single-drug therapy with endoscopically confirmed rates of healing after 8 weeks of therapy. Rates of healing for each drug and drug class were calculated using sample size and within study variance techniques. The pooled estimates of healing for each drug and drug class were compared statistically using repeated measures analysis of variance. A p value of > 0.05 was considered statistically significant. A pharmacoeconomic analysis was performed where the annual average wholesale price acquisition cost of each drug was divided by its mean rate of healing to calculate the cost per successfully treated patient.
RESULTS: A total of 48 cohorts (n=4163) included H_2RA therapy; 37 cohorts (n=2255) included PPI therapy; and 16 cohorts (n=807) included a placebo. The pooled estimates of heal rates at weeks were as follows: H_2RAs 52 ± 19%; PPIs 82 ± 13%; and placebo 20 ± 18%. Heal rates were significantly greater for PPIs than either H_2RAs ($p<0.01$) or placebo ($p>0.001$). Heal rate differences among the individual H_2RAs were not statistically significant. Heal rates among the PPIs were omeprazole 70 mg QD, 74%; lansoprazole 30 mg QD, 95%; rabeprazole 20 mg QD, 90%; and pantoprazole 40 mg QD, 90%. Heal rates with omeprazole 20 mg QD were significantly less than with the other PPI treatments ($p>0.05$). Annual cost per successfully treated patient was as follows: omeprazole 20 mg QD, $2022; lansoprazole 30 mg QD, $1506; rabeprazole 20 mg QD, $1500; and pantoprazole 40 mg QD, $1216.
CONCLUSIONS: Proton-pump inhibitor therapy is associated with significantly greater healing rates than H_2RAs in gastroesophageal reflux disease. Among the individual PPIs, omeprazole had significantly lower healing rates at 8 weeks, than the other PPIs. Healing rates among lansoprazole, pantoprazole, and rabeprazole were not significantly different. Based on cost per successfully treated patient, pantoprazole was significantly more cost-effective than other PPIs.

72. Shifting from inpatient to outpatient treatmtne of deep vein thromboses in a tertiary care center: a cost-minimization analysis. *Michel Boucher, B.Pharm., M.S.*, Marc Rodger, M.D., M.S., Mike Tierney, B.S., M.S., Jeffrey A. Johnson, Ph.D.; Ottawa Hospital, Ottawa, ON, Canada; Institute of Health Economics, Edmonton, AB, Canada.

PURPOSE: This study compares the cost of contemporary outpatient and historical inpatient management of proximal lower limb deep vein thrombosis (DVT) in adults.
METHODS: This study is a cost-minimization analysis restricted to the hospital perspective. The cost of resources required to treat proximal DVT in 50 consecutive patients using low-molecular-weight heparin is being collected prospectively in an ambulatory thrombosis clinic in a tertiary care hospital. These data are compared to the mean cost per inpatient case managed with unfractionated heparin obtained from a previous study conducted in the same patient population and institution in 1996. The inpatient sample is a subgroup of patients who would have met criteria for outpatient treatment, should this option have been available then. The analysis horizon is limited to the first week of treatment. The statistical difference between the two groups will be assessed using the Student's t-test. Data collection started in March 2000 and should be completed by December 2000.
RESULTS: Currently, data for 34 outpatients have been analyzed. The mean cost per outpatient case is $233.74 vs $2553.00 for outpatient cases (i.e., 9.2% of the cost per inpatient case before correction for inflation). Because the current sample size represents 68% of the target, it is anticipated that the final results will not significantly differ.
CONCLUSION: Converting from inpatient to outpatient treatment of proximal DVT is associated with significant cost savings for the hospital.

73. Factors affecting growth in prescription drug costs: a pharmacy benefits manager perspective. Kenneth E. Johnson, Pharm.D., Hitesh Patel, R.Ph., M.M., David Lee, Ph.D., *Michele Rath*; Caremark Rx Inc., Rx Effect, Northbrook, IL.

PURPOSE: To identify and measure key factors affecting the growth in pharmacy benefits manager (PBM)-managed pharmacy costs.
METHODS: Literature was reviewed to identify those factors that are most commonly cited as contributing to increases in pharmacy costs. Data from Caremark's pharmacy benefit database were then analyzed to estimate the absolute and relative impact of each of these factors on pharmacy costs for five major drug categories in 1999. The Caremark database includes more than 1200 employers and about 20 million covered lives. All analyses were conducted on a per-member basis.
RESULTS: Factors commonly identified as contributing to the growth in pharmacy costs include: 1) drug price inflation (i.e., changes in average wholesale drug prices and PBM-negotiated discounts); 2) introduction of new drugs in 1999; 3) changes in the mix of drugs used; and 4) changes in the drug use. Results of analysis are as follows.

Factor	Absolute Impact	Relative Impact
All	19.00%	100%
Price inflation	3.00%	16%
New drugs	3.50%	18%
Drug mix	4.50%	24%
Use	8.0%	42%

CONCLUSIONS: Changes in use of existing drugs was the main drive behind the increase in pharmacy costs during 1999, followed by changes in the mix of drugs used and the introduction of new drugs. Pharmacy price inflation made the smallest contribution to the overall growth in pharmacy costs. The analysis will be repeated for 2000 when data are available.

74. Short-course moxifloxacin lessens impact of acute exacerbation of chronic bronchitis on patient work productivity and associated costs compared to levofloxacin. *Josephine Li-McLeod, Ph.D.*, Eleanor M. Perfetto, Ph.D., M.S.; Bayer Corporation, West Haven, CT.

PURPOSE: This exploratory study used data from a comparative trial of moxifloxacin (MXF) vs levofloxacin (LEV) in the treatment of acute exacerbation of chronic bronchitis (AECB) to examine workplace-related indirect costs.
METHODS: In this prospective, double-blind, multicenter trial, patients presenting with signs and symptoms of AECB were randomized to once-daily oral therapy with 400 mg MXF (5 days) or 500 mg LEV (7 days). In addition to the primary efficacy measure of clinical response, the impact of illness on patients' work productivity and work time were assessed by patient-reported responses post-therapy. Impact on work was determined through a patient-reported severity scale of 0 to 10, with 0 indicating no impact (0% impairment) and 10 indicative of absenteeism (100% impairment). Indirect workplace productivity costs were analyzed using the model established by Greenberg, et al., as follows: productivity cost = (% available work time affected) x (impairment rate) x (period wage). National average wage estimates were obtained from the Bureau of Labor Statistics to calculate the wage for the work period for each treatment group.
RESULTS: Treatment groups were well matched with respect to demographic characteristics and demonstrated equivalent efficacy and safety profiles. Based on the severity scale, significantly higher median work productivity (70% vs 50%) was reported by MXF- compared to LEV-treated patients ($p=0.03$) during the course of illness. This translated into indirect cost-savings of $726/patient/year.

CONCLUSIONS: Both regimens were equivalent in terms of clinical efficacy and safety. However, antibiotic choice in AECB can impact worker productivity and workplace-related indirect costs. Thus, workplace-related indirect costs should be considered when making formulary selections.

75E. Cost analysis of ciprofloxacin oral suspension vs trimethoprim/sulfamethoxazole oral suspension for treatment of acute urinary tract infections in elderly women. *Josephine Li-McLeod*, Paul Cislo, Irving H. Gomolin; Bayer Corporation, West Haven, CT; Gurwin Jewish Geriatric Center, Commack, NY.

Presented at the 31st Annual Meeting of the American Society of Consultant Pharmacists, Boston, MA, November 1–4, 2000.

76. Utilization of health outcomes measures by community pharmacists to identify and resolve drug therapy problems in patients with musculoskeletal disorders. *Michael E. Ernst, Pharm.D.*, William R. Doucette, Ph.D., Seema D. Dedhiya, M.S., Matthew C. Osterhaus, B.S., Patty A. Kumbera, B.S., Jane T. Osterhaus, Ph.D., Ray Townsend, Pharm.D.; University of Iowa, Iowa City, IA; Pharmacia Corporation, Skokie, IL; Osterhaus Pharmacy, Maquoketa, IA; Outcomes Pharmaceutical Health Care Network, Des Moines, IA; Strategic Outcomes Services, Inc., Research Triangle, NC.

PURPOSE: In ambulatory patients with selected musculoskeletal (MSK) disorders (osteoarthritis, rheumatoid arthritis, or low back pain) to 1) determine if community pharmacists can use health outcomes measures to identify and resolve drug therapy problems (DTPs); and 2) examine associations between health status and number of DTPs.
METHODS: Data from a 12-month, observational study of 461 ambulatory patients with MSK disorders enrolled from 12 community pharmacies were examined. During quarterly pharmacy visits, patients used touch-screen computers to complete SF-36 health surveys as an assessment of health status. Pharmacists used the survey results to interview patients and identify DTPs. DTPs and interventions/actions to resolve them were classified and aggregated. Physical component summary scores (PCSs) and mental component summary scores (MCS) of the SF-36 were compared for patients with 0, 1, or > 1 DTPs using ANOVA (Scheffe correction).
RESULTS: Three hundred nineteen patients completed all visits. Nine hundred twenty-six total DTPs were identified, including needs additional drug therapy (32.8%), adverse drug reaction (17.3%), subtherapeutic dose (15.1%), inappropriate compliance (15.9%), and wrong drug (9.5%). Most DTPs (52.3%) were related to MSK disorders; others included gastrointestinal (7.0%) and cardiac (5.7%). Patients with 0 DTPs had significantly higher PCSs ($p<0.05$) than patients with > 1 DTPs at baseline (36.2 vs 31.6), 6 (39.2 vs 33.3) and 12 months (40.1 vs 35.4). No significant differences were noted for MCS scores. Common actions by pharmacists to resolve DTPs were patient education (40.0%), recommending OTC drug (19.2%), and contacting prescriber (14.3%), and resulted in such actions as regimen changed (20.9%), OTC drug added (17.0%), drug discontinued (9.0%), and prescription drug switched (8.5%). Although 27.6% were unchanged or stable, 70.7% of DTPs were resolved or improved.
CONCLUSIONS: Drug therapy problems are numerous in community dwelling patients with MSK disorders and correspond to decreased physical health status. Community pharmacists can use health outcomes information to identify and initiate processes to resolve DTPs. Further analyses are necessary to examine the effects of resolving DTPs on health status and health resource use.

77. Cost of irritable bowel syndrome patients in a managed care setting. *Rosalie P. Patel, Pharm.D.*, Antonio Petitta, R.Ph., MBA, Ronald Fogel, M.D., Barbara Zarowitz, Pharm.D.; Henry Ford Health System, Bingham Farms, MI.

PURPOSE: To measure the charges associated with the diagnosis and treatment of irritable bowel syndrome (IBS) patients compared to an age and gender matched cohort of non-IBS patients.
METHODS: A retrospective cohort analysis was conducted using the Henry Ford Health System corporate data warehouse. Patients with at least one diagnosis of irritable colon (ICD-9-CM 564.1) or five primary diagnoses of abdominal pain (ICD-9-CM 789.1) were identified. Data were collected for the 12 months before and after their first initial IBS diagnosis in 1998. A control cohort was identified from an age and gender matched (5:1) random sample. The average charges per patient by resource type were tabulated for 24 months.
RESULTS: A total of 599 patients with a diagnosis of IBS (69% female, mean age 47 years) and a cohort of 2988 controls were evaluated. The greatest cost contributors were inpatient care (53%), outpatient care (31%), and emergency department (7%); and outpatient care (64%), inpatient care (16%), and prescription (Rx) drugs (9%) for diagnostic codes 789.0 and 564.1, respectively.

Patient Category	Total Health Care Costs*	Total Rx Medication Costs*	Total Lab Costs*	Total Procedure Costs*	Total Emergency Department Costs*	Total Inpatient Admission Costs*	Total Outpatient Visit Costs*
IBS 564.1 n=516	$10,755	$1035	$0.14	$574	$435	$1756	$6954
IBS 789.0 n=83	$44,320	$1632	$1.18	$2501	$2991	$23,479	$13,714
Controls n=2988	$7383	$808	$0	$213	$349	$1679	$4650

*Average cost/patient/24 months

CONCLUSIONS: Irritable bowel syndrome can represent a substantial cost to managed care. More effective IBS diagnostic and management approaches are needed to decrease the cost burden of IBS.

78. The interrelationships between mortality rates, drug costs, total cost of care, and length of stay in U.S. hospitals: summary and recommendations for clinical pharmacy services and staffing. *C.A. Bond, Pharm.D., FASHP, FCCP*, Cynthia L. Raehl, Pharm.D., FASHP, FCCP, Todd Franke, Ph.D.; Texas Tech University-HSC, Amarillo, TX.

PURPOSE: This study evaluated the interrelationships and associations among mortality rates, drug costs, total cost of care, and length of stays in U.S. hospitals. The relationships among these variables and the presence of clinical pharmacy services and pharmacy staffing also were explored.
METHODS: A database was constructed from the 1992 American Hospital Association's Abridged Guide to the Health Care Field, the 1992 National Clinical Pharmacy Services Database, and the 1992 Health Care Finance Administration mortality data. A severity of illness adjusted multiple regression analysis was employed to determine the relationships and associations.
RESULTS: Study populations ranged from 934 to 1029 hospitals. The only pharmacy variable associated with positive outcomes with all four health care outcome measures (mortality rates, drug costs, total cost of care, and length of stay) was the number of clinical pharmacists per occupied bed. For mortality rate, drug costs, and length of stay, the number of clinical pharmacists per occupied bed had the highest slope (rate of change) of all the pharmacy variables with these health care outcome measures (positive effect). As clinical pharmacist staffing levels increased from the 10th percentile (0.34 clinical pharmacist/100 occupied beds) to the 90th percentile (3.23 clinical pharmacists/100 occupied beds), hospital deaths declined from 113 deaths/1000 admissions to 64 deaths/1000 admissions (a 43% decline). This resulted in a reduction of 395 deaths/hospital per year when clinical pharmacist staffing was at the 10th percentile and 90th percentile, respectively. This translated into a reduction of 1.09 deaths/day/hospital having clinical pharmacy staffing between these staffing levels, or $320 of pharmacist salary cost/death averted. Three hospital pharmacy variables were associated with reduced length of stay in 1024 hospitals: drug protocol management (slope = -1.30; $p=0.008$), pharmacist participation on medical rounds (slope = -1.71; $p<0.001$), and the number of clinical pharmacists per occupied bed (slope = -26.59; $p<0.001$). As drug costs per occupied bed per year increased, severity of illness adjusted mortality rates decreased (slope = -38,609,852; $r^2=8.2\%$; $p<0.0001$). As the total cost of care per occupied bed per year increased, severity of illness adjusted mortality rates decreased (slope = -5,846,720,642; $r^2=14.9\%$; $p<0.0001$). Seventeen clinical pharmacy services were associated with improvements in mortality rates, drug costs, total cost of care, and length of stay in U.S. hospitals
CONCLUSION: This study, along with our four previous studies, unequivocally documents the value of clinical pharmacists and clinical pharmacy services in patient care in our nation's hospitals. It is our hope that pharmacists use these results to continue the development of the clinical pharmacy movement which began a mere 30+ years ago.

79. Physician responses to the community pharmacist intervention in the study of cardiovascular risk intervention by pharmacists. Andrew J. Cave, M.D., M.Cl.Sc., Jeffrey A. Johnson, B.S., Ph.D., *Scot H. Simpson, B.S., Pharm.D.*, Tim Lau, B.S., Karen B. Farris, B.S., Ph.D., Ross T. Tsuyuki, B.S., Pharm.D., M.S.; University of Alberta, Edmonton, AB, Canada.

PURPOSE: In the study of cardiovascular risk intervention by pharmacists (SCRIP), community pharmacists identified patients at high risk for cardiovascular disease (CVD) events, identified CVD risk factors, and referred the patients to their primary care physician. This offered an opportunity to explore the pharmacist-physician relationship. The purpose of this study was to describe physician opinions on pharmacist intervention.
METHODS: Questionnaires were mailed to all physicians who were contacted as part of the pharmacist intervention program in SCRIP. Questions were designed to elicit physician opinions in five key areas: 1) the concept of a pharmacist intervention; 2) the process used to communicate information; 3) whether the intervention improved relationships with pharmacists; 4) whether patient outcomes improved; and 5) support for similar initiatives in other diseases.
RESULTS: Of the 239 eligible physicians, 141 (59%) returned useable surveys. Respondents' attitudes were neutral to slightly positive toward the concept of pharmacist interventions, with one-third indicating the intervention was useful to them. The faxed form used to identify high-risk patients and communicate with the physicians was considered to be an efficient means of conveying information. Physicians were neutral about improved communication/relationships with pharmacists and effect on patient outcomes. Written comments indicated some negative attitudes, including duplication of services, differentiation of professional roles, and training of pharmacists. Respondents supported similar interventions in other areas, especially medication compliance.
CONCLUSIONS: Physicians appeared to have mixed attitudes toward the SCRIP program and the process used. Furthermore, they identified the need

for enhanced communication/collaboration and would welcome similar interventions in other areas.

Pharmacoepidemiology

80. Adherence to treatment recommendations for uncomplicated urinary tract infection. *Julie M. Johnson, Pharm.D.*, Rex W. Force, Pharm.D., FCCP, BCPS, Craig Kelley, B.S., Paul Cady, Ph.D., Vaughn Culbertson, Pharm.D., Wendy Force, B.S.; Idaho State University, Pocatello, ID.

PURPOSE: To evaluate adherence to treatment recommendations for uncomplicated urinary tract infection (UTI), including drug choice and treatment duration.
METHODS: A retrospective, observational study using a statewide computerized relational database (n≅83,256 prescriptions/month) was conducted to examine uncomplicated UTI antimicrobial regimens among non-pregnant women aged 18-50. Exclusion criteria included hospitalization or diagnosis of UTI or pyelonephritis in the previous year, and receipt of any antibiotic prescription in the previous 3 months. Antibiotic treatment was attributed to the diagnosis if it occurred from 3 days before diagnosis date to 6 days after diagnosis date. Antibiotic treatment duration was calculated based on the quantity dispensed and the approved dosing schedule for the individual agents. Appropriate regimens were defined according to published recommendations and included TMP/SMX DS or a fluoroquinolone for 3 days, nitrofurantoin for 7 days, or fosfomycin for one dose.
RESULTS: Over a 2-year period, 209 uncomplicated UTI regimens were identified. Of these, 32 (15%) were treated with an appropriate regimen; 88% (184/209) of regimens included appropriate antibiotics. Of those, treatment duration was longer than recommended in 83% (152/184). Antibiotic treatment choices were as follows: TMP/SMX 115 (55%), nitrofurantoin 41 (20%), fluoroquinolones 27 (13%), fosfomycin 1 (0.5%), and other antibiotics 25 (12%). Three days of SMX/TMP or a fluoroquinolone were used in 10 (5%) and 3 (1%) cases, respectively.
CONCLUSIONS: This group of women with uncomplicated UTIs was treated with longer than recommended antimicrobial regimens. Further research is needed to identify barriers to the adoption of short-course therapy for uncomplicated UTI.

81. Do medication warnings influence prescribing? The marketplace lifecycle of cisapride and troglitazone. *Julie M. Johnson, Pharm.D.*, Rex W. Force, Pharm.D., FCCP, BCPS, Paul Cady, Ph.D., Hemant Phatak, B.S.; Idaho State University, Pocatello, ID.

PURPOSE: To evaluate the impact of "dear doctor" warnings on medication usage.
METHODS: A retrospective, observational study using a statewide computerized database (n≅83,256 prescriptions/month) of medical claims was conducted to observe the marketplace lifecycle of cisapride and troglitazone. Monthly counts of the total number of prescriptions and the number of new prescriptions filled for each study drug were performed. New prescriptions were defined as those given to patients who had never previously received the drugs. Medications usage was expressed as a rate (number per 1000 total prescriptions). The dates of "dear doctor" letters and label revisions were verified. A binomial comparison of the 5 months before and after each revision was made using Poisson distribution.
RESULTS: Overall, cisapride usage increased after the first alert in 1995 (3.5 to 4.5/1000; $p<0.01$), but the number of new prescriptions did not change. The 1998 letter prompted no change, but the 1999 and 2000 letters resulted in a decrease of both overall usage and new prescriptions ($p<0.01$). Troglitazone was the subject of two letters in 1997; and following these, the overall usage increased (1.6 to 2.8/1000; $p<0.01$) while the number of new prescriptions decreased (0.4 to 0.2/1000; $p<0.01$), explained by reinitiation in patients who previously received troglitazone. Following a 1998 alert, overall usage increased whereas new prescriptions decreased ($p<0.05$). A fourth letter sent in 1999 resulted in a decrease of overall usage and new prescriptions ($p<0.01$).
CONCLUSIONS: Only after multiple warnings regarding safety and monitoring issues did usage of the medications decline.

Pharmacokinetics/Pharmacodynamics/ Pharmacometrics/Drug Metabolism

82. Pharmacokinetic effects of rofecoxib therapy on lithium. *Terrie A. Sajbel, Pharm D.*, Gary W. Carter, B.S., Roy B. Wiley, M.S.; Colorado Mental Health Institute at Pueblo, Pueblo, CO.

PURPOSE: To establish the effects of rofecoxib on patients taking lithium.
METHODS: Ten patients who were on lithium were given rofecoxib 50 mg for 5 days of therapy to treat various pain states requiring nonsteroidal anti-inflammatory drug (NSAID) therapy. Other NSAIDs, angiotensin-converting enzyme inhibitors, diuretics, or changes in lithium dosing were prohibited during treatment and within 3 days of therapy. Lithium levels and creatinine were drawn the morning before rofecoxib therapy, representing baseline levels, the day after the first dose, at steady state, and after discontinuation of therapy. The lithium levels were compared using Pearson linear correlation to derive the correlation coefficients. Comparisons were made between lithium levels, creatinine levels, and differences between these levels.
RESULTS: There is a highly statistical correlation between the starting lithium level and the change at steady-state level ($p=0.001$). Lithium levels were increased in all but one patient. After the first dose one patient had mild symptoms of toxicity and her level was 1.63 mmol/L (0.4–1.6). She was removed from the study. Two other patients were asymptomatic but had levels of 1.47 mmol/L and 1.26 mmol/L at steady state and were taken off the study before the last dose of rofecoxib was given. All patients returned to near baseline lithium levels after stopping the rofecoxib.
CONCLUSIONS: Rofecoxib can increase lithium levels. The combination is particularly a concern when patients have a higher starting lithium level. More studies are needed to determine risk factors for increased levels and predicting lithium levels if the combination is prescribed.

83. Are we overdosing patients receiving concurrent intravenous and inhaled tobramycin? *Megan J. Montgomery, Pharm.D.*, Paul M. Beringer, Pharm.D., Mark A. Gill, Pharm.D., Stan G. Louie, Pharm.D., Bertrand Shapiro, M.D.; University of Southern California, Los Angeles, CA.

PURPOSE: Inhaled tobramycin (INT) improves pulmonary function and reduces hospitalization in cystic fibrosis (CF) patients when administered chronically as 300 mg BID for 28 days on, 28 days off cycle. A regimen containing intravenous tobramycin (IVT) concurrently is often prescribed to treat acute pulmonary exacerbations in these patients. The purpose of this study is to evaluate whether INT significantly affects the serum concentrations of IVT and define appropriate dosing and monitoring strategies.
METHODS: Tobramycin serum concentrations from 20 adult CF patients under routine clinical care were fitted to a one-compartment model using MAP Bayesian analysis. Serum concentrations were predicted based on doses of 3.3 mg/kg q8h and 10 mg/kg/QD. Monte Carlo simulation (ADAPTII) was performed using published pharmacokinetic data on INT. The simulations were performed to model the effects of 1) simultaneous administration of INT and IVT; and 2) INT given 1 hour before the IVT on serum concentrations and AUC. The mean prediction errors (ME) were calculated to evaluate the bias that concurrent INT administration would have on peak and trough levels and AUC.
RESULTS:

	Median Peak Serum Level (mg/L)	Median Trough Serum Level (mg/L)	Median Prediction Error Peak Level (%)	Median Prediction Error Trough Level (%)	AUC (mg•h/L)
3.3 mg/kg q8h	9.40	1.85	--	--	107.53
IT simultaneously	10.42	2.05	1.36 (18.73%)	0.24 (16.19%)	130.27
IT 1 hour before	10.08	4.06	1.05 (11.32%)	1.68 (141.46%)	180.51
10 mg/kg/QD	20.42	0.1	--	--	106.12
IT simultaneously	21.44	0.39	1.36 (8.53%)	0.24 (301.43%)	139.59
IT 1 hour before	21.1	1.75	1.05 (5.38%)	1.68 (2548.43%)	227.84

The median AUC for INT is 19.47 which is 21% of the AUC for IVT.

CONCLUSIONS: The administration of INT has a time-dependent effect on serum concentrations of IVT. Drug levels should be obtained when INT is given separate from the IVT dose. If INT and IVT are administered concurrently, the intravenous dose should be decreased by 20%.

84. Pharmacokinetics and pharmacodynamics of ciprofloxacin in adult cystic fibrosis patients. *Megan J. Montgomery, Pharm.D.*, Paul M. Beringer, Pharm.D., Mark A. Gill, Pharm.D., Amir Aminimanizani, Pharm.D., Stan G. Louie, Pharm.D., Diane Citron, M.T., Roger Jelliffe, M.D., Bertrand Shapiro, M.D.; University of Southern California, Los Angeles, CA.

PURPOSE: Pharmacodynamic data on ciprofloxacin indicate that an AUC:MIC ≥ 125 is necessary to achieve optimal bactericidal activity for Gram-negative pneumonia. The purpose of this prospective study was to: 1) develop a pharmacokinetic (PK) model to be used for therapeutic drug monitoring (TDM) of ciprofloxacin; and 2) evaluate current ciprofloxacin dosing for pneumonias in cystic fibrosis (CF) patients.
METHODS: Twelve adult CF patients received a single 400 mg dose of IV ciprofloxacin. Six blood samples were obtained during a 12-hour interval. Serum drug concentrations were determined by HPLC and were fitted to a one- and two-compartment model, using IT2B. Ciprofloxacin MIC data on *Pseudomonas aeruginosa* were obtained from 43 CF patients. Monte Carlo simulation was performed to estimate the probability of attaining an AUC:MIC ≥ 125.
RESULTS: A 2-compartment model best describes the serum concentration data. The fitted PK parameters are V_c = 0.39 L/kg, V_{ss} = 1.15 L/kg, CL_T = 0.33 L/hour/kg, CL_D = 0.77 L/hour/kg, $t_{1/2\alpha}$ = 0.17 hour, $t_{1/2\beta}$ = 2.85 hours. The overall probabilities of achieving an AUC:MIC ≥ 125 against *Pseudomonas aeruginosa* isolates with ciprofloxacin 400 mg q12h and q8h were 14.1% and 20.1%, respectively; in sensitive isolates (MIC ≤ 1), the corresponding values were 26.4% and 40%, respectively. Additional higher dosage regimens will be presented. Median (interquartile range) AUC:MIC ratios were 70 (37-149)

and 105 (56-223) in the q12h and q8h groups, respectively.
CONCLUSION: The pharmacokinetics of ciprofloxacin in adult CF patients are best described using a two-compartment model. The recommended doses of 400 mg q8h or q12h may be inadequate to treat an acute pulmonary exacerbation when given alone. The poor and variable AUC:MIC ratios support the use of TDM to monitor efficacy of ciprofloxacin in these patients.

85. A pharmacodynamic model of nitroglycerin vs cerebral blood flow in healthy volunteers. *Nancy W. Fucile, Pharm.D.,* Alan Forest, Pharm.D., Edward M. Bednarczyk, Pharm.D.; Veterans Administration Western New York Healthcare System; State University of New York at Buffalo, Buffalo, NY.

PURPOSE: To model the pharmacodynamic effect of nitroglycerin (NTG) infusion on cerebral blood flow as measured by positron emission tomography (PET), and blood flow velocity as measured by transcranial doppler (TCD).
METHODS: This is an open-label pilot study of 12 healthy volunteers. Cerebral blood flow (CBF) and blood flow velocity in the middle cerebral artery (MCA) were measured by H_2O^{15} PET and TCD at baseline and at increasing NTG rates of 0.125, 0.25 and 0.5 µg/kg/minute. A direct effect stimulatory/inhibitory sigmoid E_{max} pharmacodynamic model was fit to the data using the maximum likelihood module of the ADAPT II‰ program. Akaike's information criterion was used to determine the best model.
RESULTS: Cerebral blood flow increased 23% from baseline ($p<0.01$) at a 0.125 µg/kg/minute NTG infusion rate. Increases to 0.25 and 0.5 µg/kg/minute did not result in any further significant increase in cerebral blood flow. Mean blood flow velocity of the MCA decreased 13% from baseline ($p<0.01$) at a NTG infusion rate of 0.125 µg/kg/minute and 20% from baseline ($p<0.01$) at an infusion rate of 0.25 µg/kg/minute. An infusion rate of 0.5 µg/kg/minute did not result in any further significant reduction in blood flow velocity. The final model was unbiased and fit the CBF ($r^2=0.792$) and TCD data (right MCA: $r^2=0.706$; left MCA: $r^2=0.762$).
CONCLUSIONS: This is the first pharmacodynamic model proposed which attempts to describe the relationship between NTG infusion rates and pharmacodynamic response in the brain. We chose a simple Hill-type E_{max} model which fit the data well despite inherent variability in the measurements.

86. Population pharmacokinetic and pharmacodynamics remodeling of three-compartmental epidural lidocaine in geriatric patients. *Andrea L. Kwa, B.S.,* Juraj Sprung, M.D., Ph.D., Roger Jelliffe, M.D.; Singapore General Hospital, Singapore; Mayo Foundation, Rochester, MN; University of Southern California, Los Angeles, CA.

PURPOSE: To describe and record the clinical experience with the behavior of epidural lidocaine in geriatric patients in the form of a population pharmacokinetic model. From which, the pharmacokinetic (PK) is characterized in this target population.
METHODS: Nine patients older than 65 years of age undergoing prolonged peripheral vascular surgery under continuous lidocaine epidural anesthesia were studied. Arterial samples were taken for total plasma lidocaine concentration (gas-chromatographic assay) just before injecting the first epidural dose (baseline) and then at 5, 15, 30, 60, 90, 120 minutes and hourly thereafter. Samples were taken when the lidocaine infusion was stopped at the end of the surgery and at 30 minutes, 60 minutes, 90 minutes, 2 hours, 3 hours, 4 hours, and 5 hours after surgery. USC*PACK program was used for PK analysis. The assay error polynomial was determined as $0.2*C^0 + 0.05*C^1 + 0 + 0$. The parametric iterative two-stage Bayesian (IT2B) was used to get γ, (i.e., 1.143). The nonparametric EM (NPEM) population modeling program was used to obtain the entire discrete joint parameter distribution.
RESULTS: Five PK parameters were identified. The population model, which was linear, included three compartments with first-order elimination kinetics.

	k_{1-2}	k_{2-0}	k_{2-3}	k_{3-2}	V
Mean ($hour^{-1}$)	39.9358	0.227550	0.217090	0.130758	106.365
SD	28.0831	0.105254	0.106250	0.0806221	31.7539
CV %	70.3206	6.2555	48.9429	61.6575	29.8538

CONCLUSIONS: Dosage regimen can be developed with optimal precision using a PK/pharmacodynamic model, especially in this population requiring epidural lidocaine, where toxicity may result.

87. Pharmacokinetics of escalating doses of oral pentoxifylline in children with acute Kawasaki disease. *Brookie M. Best, Pharm.D.,* Jane Burns, M.D., Emily Chou, M.D., John Wilson, M.D., John DeVincenzo, M.D., Stephanie Phelps, Pharm.D., Edmund V. Capparelli, Pharm.D., James D. Connor, M.D.; University of California at San Diego; Children's Hospital and Health Center, San Diego, CA; Louisiana State University Medical Center, Shreveport, LA; University of Tennessee, Memphis, TN.

PURPOSE: Pentoxifylline (PTX) may decrease coronary artery damage in Kawasaki disease (KD) by inhibiting TNF-α production. This study evaluated the pharmacokinetics and safety of PTX as a putative adjunct to intravenous immunoglobulin and aspirin in the treatment of acute phase KD in children.
METHODS: Six patients were enrolled in each cohort (cohort A- 3.3 mg/kg/dose TID; cohort B- 5 mg/kg/dose TID). Six PK sera collected around the first dose were measured by HPLC and evaluated by non-compartmental analysis for PTX and its active metabolite (M-I).
RESULTS: Six patients from cohort A and five patients from cohort B were evaluated. Mean ± SD ages were 33 ± 21 months. The PTX mean AUCs were 559 (range 216–1886) and 1786 (range 286–9199) ng•hr/ml, and the M-I mean AUCs were 950 (range 363–1826) and 3162 (range 1069–12055) ng•hr/ml for cohorts A and B, respectively. Peak PTX concentrations of 391 (range 83–2582) and 911 (range 342–2924) ng/ml occurred at 0.5 and 0.4 hours, respectively, in Cohorts A and B. The overall apparent clearance (Cl/F) was 5.9 (range 1.7–15.9) and 2.8 (range 0.9–17.5) L/hour/kg. The M-I/PTX ratio was similar in cohorts A and B, 1.7 and 1.8, respectively. No evidence of accumulation or saturation of absorption was noted.
CONCLUSIONS: Pentoxifylline was well tolerated in this study, and the pharmacokinetic parameters were highly variable and similar to those seen in other populations. Currently, additional cohorts are being studied at higher dose levels to find the optimal dose of PTX in KD.

88. Itraconazole capsule bioavailability is not significantly affected by concomitant sucralfate administration. *Chris A. Gentry, Pharm.D.,* Helen T. Newland, Pharm.D., E. M. Hampton, Pharm.D.; Oklahoma City VA Medical Center, Oklahoma City, OK; University of Nebraska Medical Center, Omaha, NE.

PURPOSE: Itraconazole (ITR) capsule bioavailability is greatly reduced when given in patients receiving agents which suppress gastric acid production. This study compared the bioavailability of a single 400 mg dose of ITR capsules with or without administration of sucralfate (SU), a common alternative for gastrointestinal disorders.
METHODS: Ten healthy volunteers participated in this randomized, crossover study. Individuals were randomized to receive nothing before ITR or receive SU 1 g tablets every 6 hours for five doses, with the last dose administered 30 minutes before ITR administration. The volunteers then received four 100 mg ITR capsules with a standardized breakfast. Ten postdose serum samples (through 48 hours) were obtained after ITR administration for ITR and hydroxyitraconazole (H-ITR) concentrations. A 2-week washout period occurred before conducting the crossover regimen. T_{max} and C_{max} were determined by visual inspection, and AUC_{0-48hr} was determined by the trapezoidal rule. These parameters were statistically compared using ANOVA.
RESULTS: There were no adverse events or withdrawals. The parameter means (± SD) for ITR and H-ITR with or without prior SU were:

	ITR		H-ITR	
Parameter	Alone	+ SU	Alone	+ SU
T_{max} (hour)	3.15 (1.20)	3.14 (0.735)	5.46 (1.41)	5.27 (2.72)
C_{max} (ng/ml)	433 (272)	432 (197)	453 (274)	444 (134)
AUC_{0-48hr} (ng·hr/ml)	5702 (2906)	5547 (2101)	10297 (6465)	9617 (5415)

None of the ITR or H-ITR parameters statistically differed in relation to sucralfate administration.

CONCLUSIONS: The bioavailability of ITR capsules after a single dose appears to be unaffected by concomitant SU administration.

Pharmacy Practice

89. A national survey of pharmacist-certified diabetes counselors. *Laura Shane-McWhorter, Pharm.D.,* Joli D. Cerveny, Pharm.D., Nanette Bultemeier, Pharm.D., Gary Odera, Pharm.D.; University of Utah, Salt Lake City, UT; Medical University of South Carolina, Charleston, SC; Oregon State University, Portland, OR.

PURPOSE: The purpose of this study was to conduct a national survey of pharmacist certified diabetes educators (CDEs) to determine their education, training, professional, and academic affiliations, as well as their practice sites. The study also determined whether these pharmacists are billing for their clinical services and whether they have a system in place for measuring outcomes.
METHODS: Pharmacist CDEs were sent a confidential survey and asked specific demographic questions.
RESULTS: As of August 31, 2000, there are 415 pharmacist CDEs in the United States. A total of 211 (51%) pharmacists answered the survey. Of these, 86 (41%) are male and 125 (59%) are female. There were 170 pharmacists who have a bachelor's of science (BS) degree in pharmacy. Of these, 52 also have a doctor of pharmacy (Pharm.D.) degree, and 93 have an entry-level Pharm.D. degree. Of the respondents, 34 (16%) completed a pharmacy practice residency, 34 (16%) completed a specialty residency, and 10 (5%) completed fellowship training. The mean number of years since becoming a licensed pharmacist was 17 years, and the mean number of years since becoming a CDE was 4.67 years. Practice settings included ambulatory care clinics (43%), independent pharmacies (20%), retail pharmacies (15%), acute-care hospitals (14%), self-employment (3%), industry (3%), long-term care facilities (1%), and home health care (1%). A total of 110 (52%) had academic affiliations with a college of pharmacy. A total of 48% of pharmacists answered they are billing for their services, and 58% said they

have a system in place to measure outcomes.
CONCLUSIONS: Of 415 pharmacist CDEs surveyed, 51% returned the questionnaire. Most are female, over half have a BS degree only, have been practicing pharmacy for an average of 17 years and have been a CDE for about 5 years. Practice sites are mostly outpatient settings, including ambulatory care clinics, independent, and retail pharmacies. More than half also have academic affiliations with a college of pharmacy. About 50% of these pharmacists are billing for their service, and 58% have a system in place for measuring outcomes.

90E. Retention and promotion of clinical track pharmacy faculty: examination of U.S. pharmacy schools. *Patricia L. Orlando, Pharm.D., Karen M. Gunning, Pharm.D.*, Laura Shane-McWhorter, Pharm.D., William J. Rusho, M.S., Gary M. Odera, Pharm.D., MPH, Douglas E. Rollins, M.D., Ph.D.; University of Utah, Salt Lake City, UT.

Presented at the Annual Meeting of the American Association of Colleges of Pharmacy, San Diego, CA, July 2000.

91. Community pharmacists' opinions regarding practice-based research. *Scot H. Simpson, Pharm.D.*, Jeffrey A. Johnson, Ph.D., Catherine Biggs, B.S., Rosemarie S. Biggs, B.S., Arlene Kuntz, BSP, Bill Semchuk, Pharm.D., M.S., Jeff G. Taylor, Karen B. Farris, Ross T. Tsuyuki; Institute of Health Economics and EPICORE Centre, University of Alberta, Edmonton, AB, Canada; Broadmoor Pharmacy, Sherwood Park, AB, Canada; Shoppers Drug Mart, Regina, SK, Canada; Regina Health District, Regina, SK, Canada; University of Saskatchewan, Saskatoon, SK, Canada; University of Iowa, Iowa City, IA.

PURPOSE: The ever increasing need for robust evidence to support the expanding role of pharmacists has resulted in a growth of research involving community pharmacists. This project was designed to determine community pharmacists' opinions regarding the challenges and motivations to their recent participation in a pharmacy practice-based research study.
METHODS: At the conclusion of a randomized, multicenter study, 87 community pharmacist investigators were sent a questionnaire. Four areas were explored: 1) motivating factors to participate; 2) barriers to participation; 3) communication tools used by study coordinators; and 4) design issues for future studies.
RESULTS: Fifty-eight completed questionnaires (67%) were returned. Investigators reported a desire to improve the profession and an opportunity to learn as key factors for motivating their participation. Time was the greatest barrier to participation. Although study-related activities did not take too long, respondents indicated the difficulty came with fitting these activities into their daily routine. Ongoing communication through telephone calls, in-person visits, and regular meetings are vital for maintaining interest and participation. Finally, all staff, including support personnel, should be informed of the study to ensure optimal participation.
CONCLUSION: Pharmacy practice-based research is an expanding research opportunity with two distinct advantages. First, it translates current clinical knowledge into direct application in the community. Second, it provides needed data to demonstrate the value of enhanced pharmacy practice. Thorough understanding of the pharmacists' opinions is necessary to optimize the design of future studies.

92E. Total lipid care: a patient education program with an inter-disciplinary team approach. *Miriam M. Chan, Pharm.D.*, Susanna E. Johnson, M.D., Thomas A. Wolfe, Pharm.D.; Riverside Family Practice, Columbus, OH; Pfizer, Inc., Columbus, OH.

Presented at the 22nd Annual Conference on Patient Education, Albuquerque, NM, November 16-19, 2000.

Psychiatry

93. Systolic and diastolic blood pressure changes during an 8-week course of treatment with venlafaxine XR 75 mg QD or 150 mg QD. *Philip Rolland, Pharm.D. candidate,* University of Arkansas for Medical Sciences, Little Rock, AR; Louisiana State University Medical Center, Shreveport, LA.

PURPOSE: The systolic and diastolic blood pressure readings from a group of ten patients enrolled in clinical trials were analyzed to determine whether an 8-week course of venlafaxine would produce clinically or statistically significant blood pressure changes.
METHODS: Ten patients enrolled for clinical trials had blood pressure readings taken at the beginning, weekly, and at the end of an 8-week course of treatment with either venlafaxine XR 75 mg QD or 150 mg QD. Beginning- and end-of-study readings were analyzed using correlated measures t-test.
RESULTS: The mean increase in systolic blood pressure for the venlafaxine XR 150 mg treatment group was statistically significant, $p<0.05$, two-tailed.
CONCLUSIONS: This study found no clinically significant elevations in blood pressure with either the 75 mg or 150 mg treatment groups. Only the systolic pressure for the 150 mg-treatment group showed a statistically significant change during the 8-week course of treatment. However, no dosage adjustment was made because this change was not considered clinically significant. The systolic blood pressure was never more than 140 mm Hg.

94. Long-term risperidone usage for self-injurious behavior in an institutionalized developmentally disabled population. *Nancy C. Brahm, M.S., BCPP,* H. Dix Christensen, Ph.D., Robert C. Brown, M.D.; University of Oklahoma; D.H.S., Oklahoma City, OK.

PURPOSE: Long-term risperidone usage for self-injurious behavior (SIB) was retrospectively evaluated in institutionalized developmentally disabled adults.
METHODS: All patients residing in two state-run facilities receiving risperidone for SIB were included. Monthly self-injury reports from the behavior medicine committee were reviewed from a baseline of 6 months before initiation to July 2000. Biannual Dyskinesia Identification System: Condensed User Scale (DISCUS) assessments were performed to monitor for long-term adverse effects.
RESULTS: Retrospective risperidone usage for SIB was reviewed in 16 cases. Intellectual functioning demographics: four mild, five severe, and seven profound. Consumers' age at study completion ranged from 21 to 54 with a mean of 33.9 years. Maximum total daily dosage of risperidone ranged from 0.5–6.0 mg with a 3.5 mg mean. Only two consumers had an immediate SIB worsening, whereas two others had significant improvement but returned toward baseline at 30 and 36 months. In two consumers, the increase in adverse DISCUS score stopped treatment at 7 and 29 months. In two other consumers, the DISCUS score returned to base level by a reduction in the dose. The other consumers have been successfully maintained on the risperidone from 29-52 months with a mean of 42 months.
CONCLUSIONS: Risperidone was effective in institutionalized people for up to 52 months in 75% of those with SIB.

Pulmonary

95E. The effect of telepharmacy counseling on metered-dose inhaler technique among adolescents with asthma in rural Arkansas. Ann Bynum, Ed.D., *Denise Hopkins, Pharm.D.*, Audra Thomas, Pharm.D., BCPS, Cathy Irwin, Ph.D., RNP, C.S., Nevada Copeland, M.N.Sc., CNS; University of Arkansas, Little Rock, AR.

Presented at the World Congress of High-Tech Medicine, Hanover, Germany, October 16-20, 2000.

Substance Abuse/Toxicology

96E. OTC cough and cold medication abuse is infrequent and occurs in clusters: poison center data as a surveillance method. *William A. Watson, Pharm.D.*, John J. Hellsten, Ph.D., George Thompson, MPH, Pamela Fant, Pharm.D., J. Greene Shepherd, Pharm.D., David J. George, Ph.D.; South Texas Poison Center, San Antonio, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX; Texas Department of Health, Austin, TX; University of Texas-Austin, Austin, TX; North Texas Poison Center, Dallas, TX; National Toxicology Network, Bedminster, NJ.

Published in J Toxicol Clin Toxicol 2000;38:552.

Transplantation/Immunology

97. Conversion factor for switching pediatric renal transplant recipients from cyclosporine to tacrolimus. *Lonnie D. Smith, Pharm.D.*, Aimee Sundberg, Pharm.D., Troy Somerville, Pharm.D., Joe Sherbotie, M.D.; University of Utah Hospitals and Clinics; Salt Lake City, UT.

PURPOSE: This study documented the conversion of pediatric renal transplant recipients from cyclosporine (CYA) to tacrolimus (TAC) to determine if a standardized conversion could be accomplished. To date, no standard conversion between CYA and TAC in pediatric patients has been reported in the medical literature.
METHODS: The medical records of all pediatric renal transplant recipients that had been converted from CYA to TAC were evaluated. Demographic information and patients' doses and levels before and after conversion were collected. Patients data were collected until steady state had been reached. Target tacrolimus trough levels were 6–10 ng/ml.
RESULTS: A total of 29 patients were converted from CYA to TAC for various medical indications. Five patients were either lost to follow up or had insufficient data. Subsequently, 24 patients were evaluated. Demographics: 15 were males; 9 were females; 13 were living related; 8 were cadaveric; and 3 were living unrelated recipients. Age at time of conversion ranged from 3 to 20 years. Fifteen patients had TAC doses decreased after conversion; five had no change in dose; and four required a dose increase. The average conversion for patients that required a dosage decrease was 30 mg CYA to 1 mg TAC, patients requiring no dosage adjustment 56 mg CYA to 1 mg TAC, and patients requiring a dosage increase 49 mg CYA to 1 mg TAC.

CONCLUSIONS: In pediatric renal transplant recipients a conversion of 50 to 55 mg of cyclosporine for every 1 mg of TAC appears to result in therapeutic levels of tacrolimus.

Women's Health

98. Effect of protein binding and in vitro activity of FK-463. *Erika J. Ernst, Pharm.D.,* C. Rosemarie Petzold, B.S., Ellen E. Roling, B.S., Douglas J. Keele, B.S., Michael E. Klepser, Pharm.D.; University of Iowa, Iowa City, IA.

PURPOSE: To characterize the activity of the new echinocandin antifungal agent FK-463 using microdilution and time-kill methods. Because FK-463 is greater than 90% protein bound, we also sought to determine the impact of protein binding on the in vitro activity.
METHODS: Approved techniques for microdilution minimum inhibitory concentration (MIC) testing were adapted and applied to FK-463. Ten candida isolates, including four species, were selected for testing. Doubling dilutions of FK-463 were tested at concentrations ranging from 0.0039 to 4 µg/ml. The MIC was read after 48 hours of incubation, as the concentration resulting in 80% inhibition and 100% inhibition compared to control wells containing no antifungal. MICs also were conducted with the addition of 10%, 20%, and 50% human serum and plasma to determine the effect of protein binding on the MIC. All MICs were performed in triplicate. Time-kill studies were conducted in RPMI media buffered with MOPS at concentrations ranging from 0.125 to 16x MIC. Samples for colony counting were removed at 2, 4, 8, 12, and 24 hours after the addition of antifungal. Time-kill studies were conducted in duplicate.
RESULTS: Minimum inhibitory concentrations ranged from 0.0039 to 0.25 µg/ml for all ten isolates. All *C. albicans* isolates had MIC values ≤ 0.0156 µg/ml, whereas *C. krusei* had MIC values of 0.25 µg/ml. Overall the addition of serum or plasma increased the MIC 6–7-fold for *C. albicans* and 3–4-fold for *C. krusei* and *C. tropicalis*. Time-kill studies demonstrate FK-463 is fungicidal (≥ 99.9% reduction in CFU/ml) at concentrations approximately 4–16x MIC. FK-463 was fungicidal against all isolates except one *C. albicans* isolate and two *C. tropicalis* isolates.
CONCLUSIONS: FK is a very potent antifungal agent against a variety of candida species, producing fungicidal activity in seven of ten isolates tested. The MIC is influenced by the addition of serum or plasma, indicating the high degree of protein binding may affect activity.

Clinical Pharmacy Forum

These abstracts describe the delivery, development, justification, or documentation of innovative clinical pharmacy services; they may be descriptive only and need not contain an evaluative component.

99E. Evaluation of the retrospective screening potential of the software: Interactions Plus. *Shimona Yosselson-Superstine, Pharm.D., MPH, BCPS*; Tel Aviv University, Tel Aviv, Israel.

Presented at the FIP World Congress, Vancouver, BC, Canada, September 5, 1997.

100. Implementation of a physician-referred, pharmacy-coordinated pain clinic in an outpatient cancer center. *Rachel J. Clark-Vetri, Pharm.D.,* Jeanne Chavious, MSW, LSW; Fox-Chase Temple Cancer Center, Philadelphia, PA.

Before the development of our pain clinic, there was no service at the center devoted to assessing and managing cancer pain. We saw a need for more frequent and consistent follow up at the center to improve pain control and prevent narcotic-induced side effects. The following are the steps that were taken to initiate this program: 1) development of a policy and procedure protocol for the clinic's operations; 2) development of patient assessment tools; 3) development of collaborative agreements for narcotic titration and use of adjuvant medications, laxatives and antiemetics in which the agreements allowed the pharmacist to titrate or change medications as necessary; 4) in-services given to nurses and physicians regarding the implementation of the program and instructions on referring patients to the service; and 5) an on-call service established for after hours and weekend coverage.
Copies of the assessment forms, policy and procedure protocol, and collaborative agreements will be included in the poster presentation.

101. Congestive heart failure disease state management initiative in a group HMO. *Sarah J. Billups, Pharm.D., BCPS,* Kent M. Nelson, Pharm.D., BCPS, David Berman, M.D., Michael D. Chase, M.D.; Kaiser Permanente Colorado Region, Denver, CO.

PURPOSE: To identify patients in a group model HMO with left ventricular systolic dysfunction (LVSD) and optimize their medication regimens.
METHODS: A list of probable heart failure (HF) patients was generated in June 1999. Patients met at least one of three criteria: 1) ≥ two office visits for HF in the past year; 2) hospitalization with a discharge diagnosis of HF; and 3) taking a vasodilator plus a loop diuretic plus digoxin. Additional patients were identified through physician referral. Clinical pharmacy staff screened electronic and paper charts to identify patients with a left ventricular ejection fraction ≤ 40%. Medication intervention was performed in two phases: 1) vasodilator and spironolactone initiation/titration; and 2) β-blocker initiation/titration.
RESULTS: Of 1391 charts screened, 378 patients had LVSD. Data are reported for the 334 patients who were still living and enrolled with Kaiser Permanente at the end of the first medication titration phase. At baseline, 287/334 patients (86%) were on a vasodilator, and 162/286 of these (57%) were at target doses. There were 60/334 patients (18%) on spironolactone, and 90/334 (27%) on a β-blocker. Preliminary postintervention data are available for 12/15 clinics. In these clinics, the percentage of patients on a vasodilator increased from 90% to 94%, and the percentage of these at target dose increased from 56% to 74%. The percentage of patients on spironolactone increased from 20% to 40%. β-blocker initiation and titration is ongoing.
CONCLUSION: A disease state management initiative involving clinical pharmacy staff improved vasodilator and spironolactone utilization in LVSD patients in a health maintenance organization.

102. Outcomes of a pharmacist practitioner-managed heart failure clinic. *Kathleen C. Findley, Pharm.D.,* David J. Frohnapple, Pharm.D.; North Florida South Georgia Veterans Health System, Gainesville, FL.

PURPOSE: In 1997 we established a pharmacist-managed heart failure (HF) clinic. The pharmacist practitioner is responsible for all clinic activities.
METHODS: Patients received a baseline chest x-ray, echocardiogram, electrocardiogram, review of pharmacotherapy, and clinical evaluation. Intensive patient education and compliance with lifestyle modification and pharmacotherapy were priorities. Our goals were to maximize medication regimens of proven efficacy, reduce morbidity and mortality, and manage comorbidities. Ultimately, our objectives were to prolong life, improve quality of life, and decrease the cost of HF management. Patients required frequent clinic visits until goals were obtained; then they were monitored with frequent telephone calls thereafter. Fifteen patients were randomly selected from the clinic for outcome evaluation. We evaluated the number of HF emergency department visits and hospitalizations, number of patients at angiotensin-converting enzyme (ACE)-inhibitor goal, and relative cost of treatment for 6 months before and 6 months after clinic enrollment.
RESULTS: Compared to historical controls, the 15 randomly selected clinic patients experienced six fewer HF emergency department visits and nine fewer hospitalizations over 6 months. All clinic patients achieved ACE inhibitor goals compared to 20% of the historical controls. Number needed to treat analysis demonstrated each patient treated in clinic for 6 months avoided one HF emergency department visit or hospitalization. Although cost analysis is difficult and institution-specific, cost avoidance for the 15 patients in our Veterans Affairs clinic was approximately $50,000 in the 6-month study period.
CONCLUSIONS: Pharmacist-practitioners can improve outcomes in a HF clinic setting and reduce cost of therapy. Larger prospective studies should be conducted to further evaluate these findings.

103. Impact of a pharmacist-managed cardiac risk reduction clinic on disease outcomes. *Karissa Y. Kim, Pharm.D.*; Temple University, Philadelphia, PA.

A referral-based, collaborative practice model, pharmacist-managed cardiac risk reduction clinic (CRRC) was established at the Philadelphia Veterans Administration Medical Center in January 1998. The main objective of this clinic is to assist primary care providers in managing patients with cardiac risk factors, such as hypertension, diabetes, and hyperlipidemia. A retrospective chart review was conducted on randomly selected patients to evaluate the impact of this service on disease outcomes. The primary objective was to evaluate the percentage of patients who reached the blood pressure goal < 140/90 mm Hg, HgA_{1c} < 7% and low-density lipoproteins (LDL) cholesterol goals as delineated by the National Cholesterol Education Program (NCEP) after enrollment in CRRC. Also, the percentage of patients receiving adequate antiplatelet/anticoagulant therapy was evaluated. In those with hypertension, 62% of patients seen in CRRC achieved blood pressures < 140/90 mm Hg. In those with diabetes, 50% of patients and 80% of patients seen in CRRC achieved a HgA_{1c} < 7% and HgA_{1c} < 8%, respectively (n=30). The mean HgA_{1c} was 7.34%. In those with hyperlipidemia, the mean LDL 112 mg/dL (n=43) was achieved in those patients seen in CRRC. Eighty-five percent of patients seen in CRRC achieved their LDL goal as delineated by NCEP. Finally, 83% of eligible patients with diabetes and 93% of eligible patients with hyperlipidemia were receiving aspirin prophylaxis.

104. Improving the care of patients with congestive heart failure: the review of education on angiotensin-converting enzyme inhibitors in congestive heart failure treatment (REACT) study, stage I. *Ross T. Tsuyuki, Pharm.D., M.S.,* Miriam Fradette, B.S.Pharm., Tammy J. Bungard, Pharm.D., B.S.P., Jeff A. Johnson, Ph.D., Dante Manyari, M.D., Thomas Ashton, M.D., Wendy Gordon, B.S.Pharm., Pharm.D., Roland Ikuta, M.D., M.S., Jan

Kornder, M.D., Elizabeth MacKay, M.D., MPH, Ken O'Reilly, M.D., Bill Semchuk, M.S., Pharm.D., Ivan Witt, M.D.; University of Alberta, Edmonton, AB, Canada; Penticton General Hospital, Penticton, BC, Canada; Royal Columbian Hospital, New Westminister, BC, Canada; Lethbridge Regional Hospital, Lethbridge, AB, Canada; Surrey Memorial, Surrey, BC, Canada; Peter Lougheed Center, Calgary, AB, Canada; Royal Alexandra Hospital, Edmonton, AB, Canada; Regina Health District, Regina, SK, Canada; Medicine Hat Regional Hospital, Medicine Hat, AB, Canada.

PURPOSE: Although angiotensin-converting enzyme inhibitors (ACEI) are of proven benefit in managing heart failure, only about one-half of such patients receive them and many receive suboptimal doses. The purpose of stage I of REACT was to determine the effect of in-hospital interventions on ACEI usage and dosage titration.
METHODS: REACT was a 10-center trial. During stage I, consecutive patients with heart failure (primary or secondary diagnosis) were identified in hospital by a pharmacist or nurse, assessed for ACEI eligibility/dosage titration, and recommendations were made to the physician. The primary endpoint was the proportion of patients receiving ACEI at hospital admission compared to at discharge. The secondary endpoint was ACEI dose at discharge compared to hospital admission.
RESULTS: Of the 2310 patients screened, 67% were excluded from entry, most often for preserved systolic function or cognitive impairment. Of the 764 patients enrolled, 45% were female, mean age was 75 (± 13) years and mean ejection fraction was 0.31 (± 0.12). Eight percent were in New York Heart Association Functional class I, 48% in II, 37% in III, and 5% in IV. The primary etiology of heart failure was coronary artery disease in 59% and hypertension in 13%, and 50% had heart failure for > 1 year. As a result of the intervention, ACEI use increased from 58% on admission to 83% at discharge ($p<0.0001$). Average daily dose (in enalapril equivalents) also increased from admission to discharge (11.3 mg to 14.5 mg; $p=0.0001$).
CONCLUSION: A simple disease management program improved the care of patients with heart failure.

105. A randomized trial of a patient support program on medication adherence in patients with heart failure: the review of education on angiotensin-converting enzyme inhibitors in congestive heart failure treatment (REACT) study, stage II. *Ross T. Tsuyuki, Pharm.D., M.S.,* Miriam Fradette, B.S., Tammy J. Bungard, Pharm.D., BSP, Jeff A. Johnson, Ph.D., Dante Manyari, M.D., Thomas Ashton, M.D., Wendy Gordon, B.S.Pharm., Pharm.D., Roland Ikuta, M.D., M.S., Jan Kornder, M.D., Elizabeth MacKay, M.D., MPH, Ken O'Reilly, M.D., Bill Semchuk, M.S., Pharm.D., Ivan Witt, M.D.; University of Alberta, Edmonton, AB, Canada; Penticton General Hospital, Penticton, BC, Canada; Royal Columbian Hospital, New Westminister, BC, Canada; Lethbridge Regional Hospital, Lethbridge, AB, Canada; Surrey Memorial, Surrey, BC, Canada; Peter Lougheed Center, Calgary, AB, Canada; Royal Alexandra Hospital, Edmonton, AB, Canada; Regina Health District, Regina, SK, Canada; Medicine Hat Regional Hospital, Medicine Hat, AB, Canada.

PURPOSE: Education and support for patients with congestive heart failure (CHF) are thought to be important, but are often performed without comprehensive evaluation. This study evaluated a patient support program (PSP) in CHF outpatients.
METHODS: REACT was a multicenter, two-stage trial. During stage I, a pharmacist or nurse assessed consecutive CHF patients for angiotensin-converting enzyme inhibitor (ACEI) eligibility/dosage titration in hospital. Before discharge, patients were randomized to the PSP vs usual care (UC; stage II). The PSP included education about CHF and medications, self-monitoring, adherence counseling, monthly newsletters, and ongoing support. Follow up occurred at 2 weeks, then monthly for 6 months after discharge. Usual care patients received no formal counseling. The primary endpoint was ACEI adherence at 6 months between groups measured by dispensing records. Secondary endpoints included ACEI use/dosage at 6 months compared to at discharge, and clinical events.
RESULTS: Of the 276 patients randomized, preliminary data are available on 247. Angiotensin-converting enzyme inhibitor adherence at 6 months was 99% for PSP vs 98% for UC; p=NS. Angiotensin-converting enzyme inhibitors use at discharge compared to at 6 months, was similar in both groups (PSP: 90% and 85% vs UC: 92% and 84%; p=NS), as was the mean daily dose, in enalapril equivalents, (PSP: 15.8 mg and 17.1 mg vs UC: 15.8 mg and 15.9 mg; p=NS). Clinical events were substantially reduced in PSP patients, including CHF-related hospitalizations (23 vs 42) and emergency department visits (12 vs 34).
CONCLUSION: A CHF patient support program had little impact on ACEI use or adherence; however, it did reduce clinical events.

106. An Internet-based continuing pharmacy education course for managing patients with dyslipidemias: PHARMA*Learn*-Cholesterol. *Kari L. Olson, Pharm.D., B.S.,* Terri Murzyn, BSP, MCE, Ross T. Tsuyuki, Pharm.D, M.S., B.S.; University of Alberta, Edmonton, AB, Canada.

PURPOSE: To develop and deliver a practice-based continuing education (CE) pharmacy course using Internet technology.
METHODS: Course development involved a team of instructional designers, Web-based programmers, continuing education and content experts and consisted of three phases. Phase 1 was a series of focus groups, usability meetings, and a needs assessment of practicing pharmacists to determine their interest and learning needs for Internet-based education and to pilot the course. Phase 2 was the development of the educational course based on feedback from phase 1. Phase 3 was an evaluation of the course on pharmacists' knowledge and confidence with applying learning to practice.
RESULTS: Pharmacists prefer CE events that are interactive and case based. Most express willingness to participate in Internet-based education if it is easy to use, relevant to clinical practice, and able to be completed in a few short sessions. Based on this feedback, an interactive, case-based course was developed in which pharmacists learn how to identify patients at risk for cardiovascular disease, assess, and recommend appropriate lipid-lowering therapy based on the results from clinical trials, implement monitoring and follow up (similar to the procedures proven beneficial in the SCRIP study). Preliminary results from phase 3, revealed that pharmacists' knowledge scores were 36.8% (95% confidence interval [CI] = 27.7–46) before and 62.6% (95% CI = 48.9–76.2) after completing the course ($p<0.005$ for the difference). Furthermore, pharmacists' awareness of the major clinical trials and their confidence in managing patients with dyslipidemias significantly increased after completing the course.
CONCLUSION: Well-designed, Internet-based courses can lead to enhanced participant knowledge, improved satisfaction with learning, improved confidence in patient care, and better patient outcomes.

107. Education, service, and pharmaceutical care opportunities for pharmacy students through medical missions. *Deborah S. King, Pharm.D.,* Sara L. Noble, Pharm.D., T. Kristopher Harrell, Pharm.D., Marion R. Wofford, M.D., MPH; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: This presentation will describe opportunities for and the inclusion of pharmacy students in medical mission trips to Guatemala, Central America.
METHOD: In the summers of 1999 and 2000, students were invited to participate in trips to an isolated, chronically underserved area in Guatemala. Students served on teams along with volunteer pharmacists, physicians, dentists, and nurses. Students participated in extensive pretrip preparation: researching health status and area needs, identifying therapeutic requirements, and establishing inventory and necessary medical supplies. Pharmaceuticals were obtained through local, national, and international resources; then they were packed, labeled, and prepared for shipping. In Guatemala, students helped establish clinics and participated in all aspects of ambulatory care providing free health care to more than 10,000 patients.
RESULT: In 2 years of providing this opportunity, 11 pharmacy students and 4 primary care residents have participated in this annual trip. Students have had unique experiences and exposure to a variety of disease states and conditions, including malnourishment, lice/scabies infestation, musculoskeletal disorders, topical/systemic/parasitic infections, minor aches/pains, hypertension, diabetes, basic hygiene, gastroesophageal reflux disease and other gastric disorders. Students gained extensive ambulatory care experience, along with comprehensive organizational, communication, and physical assessment skills. Students also developed an understanding of how cultural diversity among patients can influence methods of providing pharmaceutical care.
CONCLUSION: Innovative training opportunities help pharmacy students and other learners acquire the knowledge, skills, and attitudes necessary to improve the health and well-being of those they serve. This report demonstrates that medical missions are an effective method to enhance the learning, training, and education of students.

108. Streamlining the medication education process in a renal transplant population with a patient medication comprehension tool, a pilot program. *Michael A. Shullo, Pharm.D.,* Lisa R. Fox-Hawranko, R.N., MSN, Carol J. Tamenne, BSN, Theresa A. Trkula, BSN, Teresa McKaveney, B.S., Kristine S. Schonder, Pharm.D.; UPMC – Presbyterian, Pittsburgh, PA.

PURPOSE: Medication noncompliance is currently the third leading cause for graft loss after transplantation. At our institution, medication education for new renal transplant recipients consisted of detailed discussions of current therapy with both nurses and transplant pharmacists. Patient feedback regarding this education program frequently sited too much information; however, there was no mechanism in place to determine whether sufficient comprehension was achieved. This pilot project documents the development of a tool to measure the level of patient comprehension and focus unit-based medication education toward specific patient needs.
METHODS: All renal transplant recipients were given a written medication examination following 2 days of pharmacist-directed medication education provided by nurses. If the patient scored less than 80% on the examination, the transplant pharmacist was consulted to provide a more individualized educational session based on the patient's defined deficiencies. Patients were retested to assess patient comprehension following intensive pharmacist intervention.
RESULTS: Twenty-three patients participated in this medication education

program. Two patients scored less than 80% on the examination, representing an 11% failure rate for the medication education program. These patients were counseled by transplant pharmacists, with a focus on identified deficiencies. Both patients were within the designated threshold when retested. Feedback from participating patients regarding this method of medication education has been positive.
CONCLUSIONS: This pilot program demonstrates that medication education should incorporate a multidisciplinary approach; however, not all patients require significant educational overlap. Intensive sessions with a transplant pharmacist may be reserved and tailored for patients with specific needs.

109. Pharmacist experience in a model for collaborative inpatient medication education. *Kerry A. Cholka, Pharm.D.,* Amy T. Calabrese, Pharm.D., Susan E. Lenhart, Pharm.D., Robert Weber, M.S., Mark Roberts, M.D., Wishwa N. Kapoor, M.D.; UPMC – Presbyterian, Pittsburgh, PA.

PURPOSE: This study was designed to standardize medication education to inpatients through the collaboration of nurses, pharmacists, and physicians. The pharmacist's role in the program was documented to provide justification for potential expansion.
METHODS: Prospective intervention and control groups were created on internal medicine units. Nurses provided ongoing medication education to patients in the intervention group who were likely to return home on discharge. Pharmacists were consulted if nursing assessment revealed: 1) admission secondary to a drug-related problem; 2) more than five medication administrations per day; 3) ten or more total medications or five or more new medications; or 4) inability to be taught by the nurse. Pharmacists provided patient education, recommendations to physicians, and documentation of interventions. Standard care was provided to patients in the control group.
RESULTS: Overall, satisfaction and medication knowledge was highest in the intervention group (84% and 76.7%) compared to the control group (70% and 65.1%). Pharmacists received consults for 79/417 (19%) of admissions and data were collected on 43/79 (54%) consults. Consults received for each criteria were: drug-related problem (eight), more than five administrations (nine), more than ten medications (29), more than five new medications (two), and unlearned after nursing instruction (three). The number of medication administrations was reduced in eight of nine patients and the total number of medications was reduced in five of 29 patients.
CONCLUSION: This collaborative program improved patient satisfaction and knowledge and enabled pharmacists to maximize their time by educating patients with complex medication regimens. This data will support continued pharmacist involvement as the program is expanded hospital-wide.

110. Impact of a clinical pharmacist on the quality of diabetes care in a private family physician office setting. *Melissa L. Sanders, Pharm.D.,* Michael R. Jacobs, Pharm.D.; Temple University, Philadelphia, PA.

PURPOSE: Little research has examined the impact of a clinical pharmacist on a private physician office. The purpose of this study was to: 1) assess baseline quality of diabetes care; and 2) evaluate the impact of voluntary physician-initiated consultation with a clinical pharmacist.
METHODS: A retrospective chart review was conducted for patients with type 2 diabetes seen between August 31, 1998, and August 30, 1999, before the arrival of the clinical pharmacist. Among 105 patients seen, physicians voluntarily consulted with the clinical pharmacist regarding 20 of these patients between October 1, 1999, and September 30, 2000.
RESULTS: The mean age of patients (11 women, 9 men) was 65.7 years. Before pharmacist intervention, the mean HgA_{1c} was 8.0 ± 1.1% (n=19). The mean systolic blood pressure (SBP) = 146 ± 16 mm Hg (n=20), and mean diastolic blood pressure (DBP) = 82 ± 8 mm Hg. Mean lipid values were: total cholesterol (TC) = 204 ± 49 mg/dl (n=19), low-density lipoproteins (LDLs) = 124 ± 44 mg/dl, high-density lipoproteins (HDLs) = 50 ± 14 mg/dl, and triglycerides (TGs) = 181 ± 99 mg/dl. The percentages of patients at treatment goals were: 15% with HgA_{1c} < 7%, 30% with BP < 130/85 mm Hg, and 40% with LDL < 100 mg/dl. After pharmacist intervention, trends were seen toward improvements in HgA_{1c}, DBP, TC, LDL, HDL, and TGs. A significant difference was found in SBP (p=0.003). Forty-five percent of patients had HgA_{1c} < 7% (p=0.08), 50% had BP < 130/85 (p=0.08), and 40% had LDL < 100 mg/dl (p=NS).
CONCLUSION: These preliminary data show an improvement in SBP and trends toward improvements in DBP, HgA_{1c} and lipids with an informal system involving a clinical pharmacist in care. These results have provided the basis for developing a structured diabetes management program that will include formal consultation with the clinical pharmacist for each patient, physician education about standards of care, and inclusion of a diabetes care flow sheet in the medical record.

111. Expanded use of low molecular weight heparin for warfarin bridging. *Melissa Anderson, Pharm.D.,* Shannon Willhite, Pharm.D., David Kuhl, Pharm.D., Steven Gubin, M.D., Francis McGrew, M.D.; Baptist Memorial Health Care, Memphis, TN.

PURPOSE: Using data from treatment algorithms for deep vein thrombosis (DVT), a low molecular weight heparin protocol was implemented for perioperative and initial management of patients requiring oral anticoagulation for atrial fibrillation (AF), prosthetic heart valves, DVT, and other cardiovascular indications to: 1) safely and effectively manage patients before therapeutic INR; and 2) save hospital days through early discharge.
METHODS: A P&T approved protocol was implemented to dose enoxaparin, warfarin, and vitamin K per pharmacist. Patients were enrolled per physician order, received enoxaparin-bridging therapy, and were followed until a therapeutic INR was achieved. Data collection included: percentage managed entirely as outpatients, hospital length of stay (LOS), LOS after protocol initiated, days to therapeutic INR, days of enoxaparin use, adverse events, and warfarin-related readmissions.
RESULTS: Forty-seven patients were enrolled between February and October 2000. Seventy-seven percent of patients were inpatients, whereas 23% were managed as outpatients (six procedures; four new onset AF). Inpatient LOS was 7.8 ± 5.4 days with post-protocol LOS being 1.4 ± 1.1 days. Enoxaparin was used a total of 7.3 ± 3.8 days, 6.8 ± 3.9 days of which represented outpatient enoxaparin administration. There were 284 days of outpatient enoxaparin use. Eighty-nine percent of patients were able to self-inject successfully. Average days to therapeutic INR was 7.2 ± 2.9 with 81% reaching goal INR, 13% exceeding goal, and 6% lost to follow up. There were no thromboembolic events and no adverse events due to increased INR.
CONCLUSION: This protocol allowed for timely discharge of patients requiring anticoagulation and avoided any thromboembolic or warfarin-related adverse events. The 284 days of outpatient therapy represents potential hospital days saved as a result of early discharge or avoided admission. Efforts are under way to expand this protocol to a broader group of physicians.

112E. Evaluation of the hemorrhagic and thromboembolic complications in patients followed in a pharmacist-managed anticoagulation clinic. *Heather R. Nugent, Pharm.D.,* Gloria P. Sachdev, Pharm.D., CDE, Barry A. Browne, Pharm.D., Paul J. Godley, Pharm.D.; Scott and White Memorial Hospital, Temple, TX.

Presented at the 35th Annual American Society of Health-System Pharmacists Midyear Clinical Meeting, Las Vegas, NV, December 3–7, 2000.

113. Assessing the appropriateness of discharge prescriptions for hospitalized HIV patients. *Robert C. Glowacki, Pharm.D., BCPS,* Joseph J. Pulvirenti M.D.; Cook County Hospital; University of Illinois at Chicago, Chicago, IL.

A variety of medical and pharmacy issues need to be considered when writing discharge medications for hospitalized HIV patients. The role of a clinical pharmacist in decreasing medication errors in this situation has not been well described.
PURPOSE: To assess the appropriateness of discharge prescriptions written for HIV patients on discharge.
STUDY SETTING: An urban, teaching, county hospital in Chicago which has a dedicated infectious disease unit (29 beds) covered by two medical teams, a clinical pharmacy specialist, a pharmacy infectious disease fellow or pharmacy practice resident, and two to four pharmacy students.
METHODS: We prospectively reviewed discharge prescriptions for patients leaving on weekdays. Areas assessed included indication, dose, frequency, length of therapy, and drug-drug interactions. Clinic appointments were necessary on discharge prescriptions so the dispensing pharmacist could calculate the medication quantity. The clinical pharmacist team member made necessary changes before the patient's medications being filled.
RESULTS: Fifty-four patients with an average of seven discharge medications were assessed between February and March 2000. Seventy-five medication errors occurred and only eight patients (15%) had their discharge medications prescribed appropriately. Errors noted included clinic appointment missing (33%), inappropriate length of therapy (24%), wrong dose (19%), missing medication (17%), and sub-optimal drug selection (7%). Drug-drug interactions were not noted because they were resolved during the patient's hospitalization.
CONCLUSION: Routine review of discharge prescriptions by a clinical pharmacist may help decrease medication errors in HIV patients.

114. Interventions performed by a clinical pharmacy team on hospitalized patients with HIV. *Kevin W. Garey, Pharm.D.,* Manjunath P. Pai, Pharm.D., Robert C. Glowacki, Pharm.D.; University of Illinois at Chicago; Cook Country Hospital, Chicago, IL.

Hospitalized patients with HIV are complex with a variety of medical and pharmacy issues. However, interventions performed by a clinical pharmacy team on hospitalized patients with HIV has not been well described.
PURPOSE: To document interventions performed by a clinical pharmacy team on hospitalized patients with HIV.
STUDY SETTING: Cook County Hospital is an urban, teaching hospital in Chicago. The hospital has a dedicated infectious disease (ID) ward, primarily HIV (29 beds) with two medical teams. A clinical pharmacy team, comprised of a clinical pharmacist attending, an ID fellow or resident, and two to four pharmacy students per month are present, full time on the ward.
METHODS: Interventions recommended by the clinical pharmacy service on patients admitted to the ID ward between June and August 1999 were

recorded. Interventions were categorized for acceptance rate and types of interventions.
RESULTS: Six hundred interventions were recommended during the study period of which > 90% were accepted. The most common areas of intervention were drug therapy recommendations (24%), dosage adjustment (19%), patient education (15%), pharmacy order clarification (9%), drug information (5%), clinical order clarification (5%), IV to PO switch (5%), and missing medication doses (5%). Other interventions (< 5% of total) were to recommend a laboratory test, pharmacokinetic monitoring, report an adverse drug reaction, nutrition counseling, anticoagulation assessment, and to facilitate an investigational drug study. Interventions were made in all pharmacological drug classes.
CONCLUSION: A clinical pharmacy team is valuable for hospitalized HIV patients and also serves as an excellent teaching service for upcoming pharmacy clinicians.

115. Patient care services provided by a group of clinical pharmacists in a multidisciplinary health care team human immunodeficiency virus clinic. *Steven T. Eggleston, Pharm.D., BCPS*, Lynn Ethridge, Pharm.D., Mark K. Hansen, Pharm.D., Lori W. Bennett, Pharm.D., BCPS, John H. Schrank, Jr., M.D.; Greenville Hospital System, Greenville, SC.

PURPOSE: To describe and evaluate services provided by a group of clinical pharmacists in a multidisciplinary health care team (MHT) human immunodeficiency virus (HIV) clinic.
METHODS: In 1997, two pharmacists joined a MHT (i.e., infectious diseases physicians, nurse practitioner, case managers, nutritionist, and social workers) who provide care one-half day each week to patients with HIV. Pharmacists provide consultative services and are available by pager for consultation during non-MHT clinic hours. Pharmacists conduct medication histories and educate patients concerning all aspects of safe and appropriate medication use (i.e., adherence, resistance, dosing, drug interactions, adverse effects). Pharmacists are also involved in student and resident physician training, lecturing, and pharmacy-conducted research.
RESULTS: Today, patient care services in the MHT HIV clinic are 2 one-half days each week with four pharmacists sharing responsibilities, each working one-half day every two weeks. Pharmacists' salaries and benefits for time spent in HIV patient care are paid with federal funding. Analysis of 34 patients in an adherence study who were educated by a pharmacist about a new antiretroviral regimen found 68% had an undetectable viral load (< 400 copies/ml) by most recent measurement. Excluding eight patients recently enrolled in the adherence study, 62% had an undetectable viral load 6 months after beginning the new regimen. Patients in one arm of the adherence study (n=15) completed satisfaction surveys. Most patients (86%) felt that pharmacists gave specific instructions and found pharmacy-developed medication information sheets helpful (73%). Fewer patients (46%) used pharmacy-provided medication calendars.
CONCLUSION: Patient care services by a group of pharmacists in a MHT setting are an efficient and effective way to improve outcomes in patients with HIV disease.

116. Evaluation of *Clostridium difficile* associated diarrhea in a tertiary care teaching hospital. William Darko, Pharm.D., *Roy Guharoy, Pharm.D.*, Donald Blair, M.D., Kathryn Same, M.S., Jill Schachtner, Pharm.D.; University Hospital, Syracuse, NY.

The objective of this study was to evaluate the trend in *Clostridium difficile* (CD) associated diarrhea events, treatment modalities, and impact of broad spectrum use on the prevalence. A retrospective chart review of 110 patients with positive CD enterotoxin between June 1999 and June 2000 was conducted. Criteria for inclusion in the study were diarrhea for > 48 hours and patients on antimicrobials before diarrhea. Patients who were admitted on antimicrobials had diarrhea event on admission, recent history of CD diarrhea or colitis, and prior hospitalization record within last four weeks, were excluded. Forty-eight eligible patients were evaluated. Forty-three percent of the CD events were associated with cephalosporin usage and 12% of the events were associated with clindamycin use. Metronidazole was the drug of choice in 86% of the cases and vancomycin was used in 10% of the cases. Four percent of the patients had resolution of symptoms without treatment. Thirteen percent of the patients received an antimotility agent. Majority of the CD events occurred in medicine (36%) and neurosurgery (17%) areas. Our findings were reviewed by both antimicrobial and pharmacy and therapeutics committee. The infectious disease team and pharmacists are now prospectively monitoring all CD events on a prospective basis to ensure appropriate use of treatment options.

117. A collaborative effort between a pharmacy benefit management organization, health care system, and three health maintenance organizations to facilitate judicious antibiotic usage: through a provider educational program, patient education, and cold pack distribution. *Donna M. Boreen, Pharm.D.*, Sara Jo Peterson, Pharm.D., Cris Solberg, Pharm.D., Marcia Hutchinson, Vito Inoferio; Prime Therapeutics, Eagan, MN.

OBJECTIVE: The Centers for Disease control (CDC) estimates more than 100 million antibiotics are prescribed by providers each year. About half of those are unnecessarily prescribed. One of the results of overuse of antimicrobials is resistance. In an effort to decrease this trend, a collaborative effort between pharmacy benefit management organizations (PBMs), health care systems, and three health maintenance organizations (HMOs) was developed. The goal was to educate both the patient and the provider, and supply patient education pamphlets and posters, and cold packs to facilitate judicious antibiotic usage.
METHODS: Through the collaborative effort of the above-mentioned groups patient education pamphlets were developed and distributed, CDC posters were used, and free cold kits were provided to clinics. This kit contained generic pseudoephedrine, acetaminophen, guaifenesin/dextromethorphan, chicken soup, and tea. Provider education was completed by a clinical pharmacist on October 24, 2000, to a health care system group of 80 providers. Cold kits were distributed to the clinics in November 2000. Measurements will include prescribing habits from November 1999 to February 2000, and post-educational efforts from November 2000 to February 2001. The results are pending the data collection. Preliminary information from a piloted program conducted by one of the HMOs participating indicates that it does indeed decrease unnecessary antibiotic usage.

118. Decreased health care utilization costs after addition of clinical pharmacy services in an internal medicine practice. *Jeanette L. Altavela, Pharm.D., BCPS*, Lori A. Geraci; ViaHealth, Rochester, NY.

PURPOSE: To assess the overall health care use of capitated patients in a 14-physician internal medicine practice before and after a clinical pharmacist began optimizing medication therapy.
METHODS: Clinical pharmacists reviewed Medicare patients charts before their visit and left consult notes as warranted to give suggestions to the physicians to improve medication therapy. The overall health care use (assessed 9 months before vs 6 months during interventions) included hospitalizations, office visits, laboratory, and radiology tests, but did not include prescription medication costs.
RESULTS: Ninety-five patients with 150 accepted interventions (intervention group) were compared to the remainder of the Medicare patients who were not intervened on, or did not have accepted interventions in the 6 months (nonintervention group). During the two time periods, the total per member per month (PMPM) cost for the intervention group decreased 35%, from $474.98 to $306.19. The total PMPM for the nonintervention group decreased 8%, from $400.07 to $366.94.
CONCLUSIONS: Overall, the total PMPM decreased substantially in the Medicare intervention group compared to the non-intervention group. The hope is that optimizing medication use in outpatients, will lead to better health care with less visits to emergency departments, less admissions to hospitals, and a decrease in overall cost of care.

119. Policy for utilization of premixed parenteral nutrition base solutions (Clinimix®) during natural disasters. *Mark A. Newnham, Pharm.D., BCPS, BCNSP*, Natalie Trach, Pharm.D.; North Broward Hospital District, Fort Lauderdale, FL.

PURPOSE: To describe a policy supporting the use of premixed parenteral nutrition (PN) base solutions when PN is not available from a centralized compounding center due to natural disaster.
METHODS: The North Broward Hospital District consists of four primary medical centers and more than 1500 inpatient beds. Our health system began coordinating centralized PN compounding at a single facility in 1997. Support for the compounding center was based on improvements in patient safety and reduction of medication errors and cost through the use of computerized compounding technology. The primary disadvantage was the elimination of PN compounding supplies, preventing the availability of PN solutions on off shifts and during times of natural disaster such as hurricanes. Our pharmacy and therapeutics committee addressed the issue of off shift PN compounding by adopting a 24-hour provision policy. We addressed the problem of natural disasters by adopting a hurricane supply policy in 1997, which states that we will stock a 72-hour supply of premixed PN base solutions without electrolytes (Clinimix®). Necessary additives are drop shipped by our wholesaler when a hurricane warning is issued. To avoid stability issues with manual PN preparation, all hurricane orders are prepared as 2-in-1, nonlipid containing admixtures. Calcium is not added to manually prepared PN solutions. Where appropriate, calcium replacement may be delivered by separate maintenance solutions infused through a second IV site.
CONCLUSIONS: Many health systems are instituting centralized PN compounding services, but no published articles describe their methods for providing PN when access to the compounding center is interrupted. Our health system is placed under a hurricane warning an average of once per year. We describe our methodology to provide uninterrupted PN solutions when under hurricane restriction. Our policy may also prove effective for health systems at risk for interruptions due to other natural disasters.

120. Development and success of a fee-for-service pharmaceutical care pain management Web site. *Jeffrey Fudin, Pharm.D.*, Anthony J. Longo, B.S.; Albany College of Pharmacy; Department of Veterans Affairs Medical Center;

ADL Consultants, Albany, NY.

PURPOSE: Several reliable medical and allied health journals have published reports clearly indicating that pain is poorly understood and undertreated. It was the authors' objective to develop an Internet Web site that would allow patients to be self-referred or referred by their health care provider. The clinical pharmacist in turn provided a written evaluation and recommendations for one's pain with the appropriate medications, while avoiding or minimizing drug-related problems.
METHODS: A comprehensive Web site was developed to include a patient intake data collection form, a physician referral form, explanation of services provided, hyperlinks to other important pain sites, the clinical pharmacist's curriculum vitae, a description of fee structure for services provided, and more. The service was made available through more than 450 search engines, and was hyperlinked from the clinician's biosketch, which was located at a prominent international pain Web site.
RESULTS: Seventeen new patients were referred from several locations throughout the U.S. As a result of establishing this site, the primary author has been contacted by several companies to provide cognitive consultation services, including two offers to appear as an expert witness. Patients were willing to pay the required fees for pharmaceutical care consultations, and in every case, physicians were pleased with the service provided.
CONCLUSIONS: The impact of offering cognitive pharmaceutical care services via the Internet should not be underestimated. Patient outcomes and physician feedback thus far have been positive. Clinical pharmacists should embrace the power of the Internet by offering their expertise in the area of pharmacotherapy and/or other cognitive services.

121. Economic viability of collaborative practice pharmacotherapy in a private physician's office. *Melanie A. Sadler, Pharm.D.*, Rex W. Force, Pharm.D., FCCP, BCPS; Idaho State University, Pocatello, ID.

PURPOSE: Justification of clinical pharmacy services has traditionally been done by cost avoidance strategies (i.e., formulary management, consults, or educational programs). However, actual reimbursement for clinical pharmacy services has been a significant barrier in developing collaborative practices. We describe the economic viability of a collaborative practice pharmacotherapy clinic (CPPC) in a private family medicine clinic by analyzing revenue generated from the CPPC and the supervising physician.
METHODS: Throughout 52 weeks, the mean number of patient visits with the clinical pharmacist and the supervising family physician and mean reimbursement per clinic (4 hours) were analyzed. We also compared the mean number of patient visits and the reimbursement from the physician's clinic when the CPPC was in session vs the times when the CPPC was not scheduled.
RESULTS: Throughout the study period, 43 CPPCs occurred. The clinical pharmacist saw an average of six patients generating $91.42 per clinic. Concurrently, the supervising physician examined 17 patients with reimbursement of $892.48. In comparison, when the CPPC was not scheduled, the physician assessed 13 patients with reimbursement of $743.74 per clinic. The combined income from the CPPC and the difference in revenue generated by the physician when the CPPC was scheduled vs not resulted in a net increase of $240.16/clinic.
CONCLUSIONS: Establishment of a CPPC in a private family practice clinic resulted in an increase in volume of patient visits and revenue generation for the supervising physician. This increased revenue in conjunction with direct billing from the clinical pharmacist improves the economic viability of a CPPC.

122. Description and cost analysis of a pharmacy-run medication management clinic in a Veterans Affairs setting. *John M. Conry, Pharm.D.*, Eric A. Wright, Pharm.D.; Wilkes University; Wilkes-Barre Veterans Affairs Medical Center, Wilkes-Barre, PA.

PURPOSE: The Wilkes-Barre Veterans Affairs Medical Center Medication Management Clinic (MMC) is a referral-based pharmacist-run clinic developed in the fall of 1999 to improve the health of area veterans. Many veterans receive complex medication regimens that require significant patient education and close monitoring for disease state efficacy and drug toxicity. Additionally, these medication regimens often include high-cost and potentially inappropriate drug therapy. The MMC was designed to assist health care providers in the optimal management of such patients. Pharmacists' responsibilities include ordering laboratory and other appropriate diagnostic tests; initiating, discontinuing, and modifying drug therapy; counseling patients; and documenting interactions. The implementation of such a clinic allows continuous assessment of clinical pharmacist interventions.
METHODS: Patients began enrolling in the MMC in October 1999. Medication changes and pharmacist hour spent were recorded following each visit to determine the effects of pharmacist interventions on pharmacy drug costs. Drug costs were estimated using archived VA acquisition costs.
RESULTS: The clinic was analyzed from October 1999 to June 2000. One hundred thirty-eight patients were seen, accounting for 187 visits. Approximately 346 hours of pharmacist time was used. Medication changes included formulary conversion, dose/schedule adjustment, discontinuation, and initiation. Below is a table of tabulated cost-savings for actual medication changes (performed), recommended medication changes (recommended) and total.

Type of Recommendation	Cost Savings/Year ($)	Cost Savings Per Pharmacist Hour Spent ($)
Performed	8104.13	23.42
Recommended	10,369.76	29.97
Total	18,473.89	53.39

CONCLUSIONS: The cost-savings, based only on medication alterations, appear to justify the salary of a clinical pharmacist devoted to such a clinic since the total cost-savings are in excess of the average clinical pharmacist salary.

123. Diabetes partners in care pilot project: patient-focused diabetes education and management in the community pharmacy practice setting. *James J. Sterrett, Pharm.D.*, Deborah S. Carson, Pharm.D., Kit Simpson, Ph.D., Sarah J. Rider, Pharm.D.; Medical University of South Carolina, Charleston, SC.

PURPOSE: Diabetes mellitus (DM) is a significant problem in the U.S. and particularly prevalent in South Carolina. This project aims to determine whether community pharmacists, equipped with diabetes management certificate training can: 1) positively impact the adherence to the American Diabetes Association (ADA) Clinical Practice Recommendations; 2) improve patient quality of life; and 3) positively affect surrogate markers of diabetes control and predictors of long-term complications in South Carolina state employees with DM.
METHODS: A 1-year retrospective and 2-year prospective case-controlled study is being performed with 257 enrolled patients and 42 study pharmacists. Community pharmacists who completed an 80-hour diabetes certificate training program were eligible to participate in the pilot. South Carolina state employees who met the following criteria were eligible: enrolled in the state health benefits plan for at least 1 year, diagnosed with DM, at least 18 years of age, not pregnant, and receiving prescriptions for oral antidiabetic medications and/or insulin.
PRELIMINARY RESULTS: Of the successfully enrolled patients, 57% either had no HgA_{1c} value recorded in their medical record over the prior year or had a value greater than the ADA goal of 7%, reflecting a needed improvement in care to reach guideline standards. Baseline data also reflected low documentation to other ADA standards of care: 27% had a recorded foot examination, 50% had a dilated eye examination, 32% were on daily aspirin, and only 25% were on an angiotensin-converting enzyme inhibitor. The initial data also reflect a high (41%) patient drop-out rate before the second pharmacy visit. Initial (1 year) results demonstrated overall improvements (decreases) in the surrogate markers: HgA_{1c} (0.61%), fasting blood glucose (17.5 mg/dl), systolic blood pressure (2.89 mm Hg), diastolic blood pressure (1.75 mm Hg) and weight (4.2 pounds).
PRELIMINARY CONCLUSIONS: Using specially trained pharmacists in the community setting may be associated with positive patient outcomes, however, the method of patient selection appears to be important in patient participation and retention.

124. Pharmaceutical care practice at a medical center, Kaohsiung Veterans General Hospital, Taiwan. *Chien-Hua Hsu, R.Ph.*, Eric K. Lee, R.Ph., MBA, M.S., Shu-Mei Chen, R.Ph., Yu-Lan Peng, R.Ph., M.Pharm., Chih-Min Mao, *R.Ph.*, Hsin-Nan Lee, R.Ph., M.Pharm., Tai-Li Wu, R.Ph., Derek K. Lee, R.Ph.; Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan; National Defense Medical Center, Taipei, Taiwan.

PURPOSE: Beginning January 1, 2000, the Kaohsiung Veterans General Hospital, Taiwan, launched a pharmaceutical care (Pcare) project for the outpatients. The Pcare model was developed by the Peters Institute of Pharmaceutical Care, University of Minnesota College of Pharmacy. We intended to perform a generalist model with patient-centered service to improve patients' medication outcomes by taking the responsibility for the patients' drug-related needs.
SERVICE DESCRIPTIONS: Four experienced pharmacists were responsible for this project, which was provided in a Pcare clinic at the afternoon 5 days/week with one patient at a time. Until August 31, 2000, 45 patients (male 27, female 18) have been received this service; average age was 58 ± 18.6 years. An average of 3.44 current medical problems per each patient and a total of 157 drug-related problems (DRPs) have been documented. An estimated percentage of the DRP category for the appropriate indication, effectiveness, safety, and convenience were 28.7%, 14%, 31.2%, and 21.7%, respectively. More than 80% of these DRPs had been resolved or at least got partial improvement and less than 1% declined in health and needed adjust therapy. Each patient also completed an exit satisfaction survey using a five-point Likert's scale after seeing the Pcare pharmacist. Not surprisingly, they rated a mean score of 4.7 for the overall satisfaction, 4.61 for word of mouth; and they were willing to pay almost NT$250 fee-for-service each time.
CONCLUSIONS: Apart from the pharmacy product-oriented origins, this project could demonstrate an opportunity for the service-oriented

pharmaceutical care practice to regain the society recognition by improving the patients' clinical outcomes and the impact on economical value to our health care system.

125. Hand-held digital device in pharmacy practice. *Lih-Jen C. Wang, Pharm.D., BCPS,* Dennis Brown, Pharm.D.; The Medical Center, Columbus Regional Healthcare System, Columbus, GA.

BACKGROUND: The personal digital assistant or hand-held digital device has been heavily developed in the past few years. Palm Pilot™ and Visor™ are the most frequently recognized portable tools for various professions including the medical industry. In addition to the usual data banks of addresses, memos, schedules, and calculations, the hand-held digital device can display valuable clinical information, such as Epocrates™, Lexidrugs™, Mathpad™, ABGPro™, Pk22™, and others. Some programs can be purchased or downloaded from the Internet (e.g., Tarascon e-Pharmacopoeia by Medscape Mobile).
DESIGN: Palm Pilots were purchased for each individual pharmacist at The Medical Center, Columbus Regional Healthcare System to assist clinical practice and documentation. One privileged application is designed solely to facilitate the communication between the pharmacy computer system and the Palm Pilots. After each synchronization, the most updated patient information, patient demographic data, and current medication list are displayed in the hand-held device. Clinical interventions can be documented through this application by only a few prompts to the predetermined intervention indicators. The convenience of electronic intervention documented by each pharmacist and the availability of immediate display of medication information at the sites of medical rounds make these devices extremely beneficial. It also serves effectively as a managerial instrument for workload statistics.
RESULTS AND CONCLUSIONS: The advanced technology and the availability of clinical information make the personal digital assistant or hand-held digital device a practical tool for health care practitioners in pharmacy practice.

126. Outcomes assessment of clinical pharmacy services on blood pressure, blood glucose, and LDL cholesterol in an indigent ambulatory population. *Martin R. Giannamore, Pharm.D.,* Ruth E. Emptage, Pharm.D.; Pfizer, Inc.; The Ohio State University, Columbus, OH.

PURPOSE: The purpose of this project was to evaluate the impact of clinical pharmacy services (chronic disease comanagement and patient education) on four parameters: systolic blood pressure (SBP), diastolic blood pressure (DBP), HbA_{1c}, and low-density lipoprotein (LDL) cholesterol.
METHODS: Data were collected retrospectively from the medical records of a selective, random sample of patients who had three or more documented clinical pharmacist visits during the study period. For inclusion into the study, baseline and follow-up data were required for patients with one or more of the following diagnoses: diabetes mellitus (DM), essential hypertension (HTN), and hyperlipidemia. Diagnosis-specific inclusion criteria were as follows: for DM, a minimum of two HbA_{1c} values after the initial visit; for HTN, a minimum of three documented blood pressure readings in the previous 6 months; and, for hyperlipidemia, any patient with a baseline LDL level above the National Cholesterol Education Program goal.
RESULTS: Medical records from 92 patients were evaluated, and 67 (73%) were eligible for inclusion into the study. Sixty-three (94%) of the eligible patients had a diagnosis of DM. The average reduction in HbA_{1c} was 2.1 ± 2.5 mg/dl (baseline vs last value; $p<0.001$). In the HTN subgroup, 17 patients had an average reduction of 6.4 ± 14.3 mm Hg and 5.8 ± 6.6 mm Hg in SBP and DBP, respectively (baseline vs average of follow-up readings; $p=0.083$ for SBP; $p=0.002$ for DBP). Eleven hyperlipidemia patients had an average LDL reduction of 67.0 ± 20.8 mg/dl (baseline vs last value, $p<0.001$).
CONCLUSION: Clinically and statistically significant reductions in HbA_{1c}, DBP, and LDL were observed in patients comanaged by a clinical pharmacist in an ambulatory care setting. The dramatic effect on HbA_{1c} has significant implications for reducing diabetes-related complications, morbidity, and mortality in this population.

127. Patients' perception of a pharmacist-administered adult immunization program. *Elizabeth W. Blake, Pharm.D.,* Rachel L. Couchenour, Pharm.D., BCPS, Melissa M. Blair, Pharm.D., BCPS; Medical University of South Carolina, Charleston, SC.

OBJECTIVE: To assess patients' perception and satisfaction of a pharmacist-administered adult immunization program in a family medicine clinic.
METHODS: Developed a 10-item cross-sectional survey with Likert scale responses. Questions were verbally administered via telephone to a random sample of patients who had received immunizations from the pharmacist 3-4 months prior.
RESULTS: Sixty-three of the > 400 patients who were vaccinated completed the questionnaire. The average respondent was 67 years old (range: 42–87), female (83%), and African American (71%). Most patients (97%) felt comfortable with their immunizer. Ninety-two percent wanted their immunizer to provide immunizations again the next year. All patients were informed at the time of their immunization that a pharmacist would administer their vaccine; however, at the time of this survey, the majority of patients thought that a nurse had administered the vaccine (59%). The majority (64%) of respondents either were undecided or disagreed that pharmacists were qualified to administer immunizations. To conclude the survey, patients were informed that pharmacists were allowed to administer vaccines. Despite this information, only 43% responded that they would feel comfortable receiving an immunization from a pharmacist in a community pharmacy.
CONCLUSION: In these data, respondents felt comfortable with the people who gave their immunizations but were unaware it was a pharmacist. Additionally, most patients were unaware that pharmacists are qualified to administer immunizations and most would not feel comfortable having a pharmacist administer immunizations in a community setting.

128. A preliminary report of a dedicated psychopharmacology second opinion survey. *Todd P. Semla, M.S., Pharm.D., FCCP,* Frederick E. Miller, M.D., Ph.D.; Evanston Northwestern Healthcare, Evanston, IL.

Second opinions are not uncommon in psychiatry and address questions of diagnosis and treatment. We report a novel practice model for conducting second opinions in outpatient psychiatry.
The model consists of a psychiatrist and a clinical pharmacist. The clinical pharmacist screens all patients to determine if they are appropriate. Prior treatment information is requested. A centralized intake center schedules the appointment and verifies insurance information. Patients are seen for 1 hour by each clinician.
The clinical pharmacist conducts a medication history and structured diagnostic interview using the Mini International Neuropsychiatric Interview (MINI). The clinical pharmacist briefs the psychiatrist regarding the patient's current and past medications and problems that may need to be explored during the examination. The psychiatrist then performs a clinical psychiatric examination. The psychiatrist and clinical pharmacist confer and develop an evidence-based treatment plan. Recommendations are individualized to address symptoms, concurrent medications, and comorbid conditions. Referring clinicians are contacted within one or two working days and a written report is mailed.
Begun in February 2000, 42 patients had been evaluated as of November 2000. Women referrals outnumber men by 2:1 and ages range from 17 to 74 years. The most common presenting diagnosis is major depressive disorder that has not responded to pharmacotherapy and/or psychotherapy. Patients who have been unable to tolerate multiple antidepressants are also common. Comorbid conditions include chronic pain, post-traumatic stress syndrome, social anxiety disorder, and panic disorder. Analysis of all cases seen in the first year will be presented.

129. Development of a collaborative antidepressant initiation and monitoring service. *Joli D. Cerveny, Pharm.D.,* Bart Lawrence, Pharm.D., Alissa R. Segal, Pharm.D., M.K. Wiley, M.D., Nannette M. Turcasso, Pharm.D., Brigitte T. Luong, Pharm.D., Laura Shane-McWhorter, Pharm.D., Rachel L. Couchenour, Pharm.D., Nanette C. Bultemeier, Pharm.D.; Medical College of Virginia, Richmond, VA; University of Utah, Salt Lake City, UT; Medical University of South Carolina, Charleston, SC; Oregon State University, Portland, OR; Pfizer, Inc., Charleston, SC.

PURPOSE: The clinical and social benefits of treating depression with antidepressants have been well established. Nonadherence to antidepressant medications has been identified as a significant barrier to successful treatment. It is believed that clinical pharmacists could positively affect medication adherence and continuity of care by establishing a collaborative practice with physicians for managing depression. The goal of the service is to educate patients, identify and address barriers associated with treatment, monitor therapeutic outcomes, and improve adherence in this patient population.
METHODS: The clinical service was created by obtaining support of attending physicians, collecting baseline adherence information from the outpatient pharmacy, creating a service protocol, and developing a Microsoft Access' database for following patients. Physicians referred patients to the service at the time of antidepressant initiation. Clinical pharmacists provided baseline education, scheduled follow up with patients through telephone and clinic contacts, and provided feedback to the primary care physician.
RESULTS: This clinical pharmacy service has been established. The Microsoft Access database has become a useful component of the service, providing follow-up scheduling, individual patient records, and compiling summary information.
CONCLUSION: A collaborative practice model for managing depression may be accomplished with receptive physicians, developing a standardized protocol, and using a database. Similar services may be initiated and maintained with minimal financial resources.

130. Costs and benefits associated with an asthma management service employing electronic peak flow monitoring. *Renee M. Trewyn, Pharm.D.;* University of Oklahoma, Tulsa, OK.

PURPOSE: This study quantified the costs associated with an asthma management service employing computer-assisted electronic peak flow

monitoring as a function of patient's level of asthma severity and monitored changes in patient status by following selected patient indicators.
METHODS: Medical records of patients in a pharmacy asthma management service were reviewed. Patient asthma severity was assigned at the first visit per NCEP2 guidelines. Numbers of months in the service, electronic reports reviewed, phone calls to patient or physician, consult letters, and visits to clinic were determined for each patient. A standard number of minutes per intervention was used and costs calculated based on $75 per hour of pharmacist time. Indicators of patient status included minimum and maximum PEF and FEV_1 measures, and markers of poor PEF/FEV_1 technique. Patient reported indicators included missed school/work days, emergency department visits, and unscheduled doctors' appointments for asthma exacerbations.
RESULTS: Asthma severity level for the patients enrolled in the asthma management was as follows: 25% step 4 severe persistent; 31% step 3 moderate persistent; 44% step 2 mild persistent. The average cost per month per patient (± SD) for those with severe persistent asthma was $65.81 (± $6.94), moderate persistent $46.56 (± $27.53) and mild persistent $44.47 (± $13.87). All patients showed improvement in PEF/FEV_1 minimum and maximum values, 94% of the patients showed improved PEF/FEV_1 technique. Patient reported variables indicated improved patient status.
CONCLUSIONS: Electronic peak flow monitoring is a valuable addition to an asthma management service. Clinician time outside of direct patient visits must be included in estimating the cost.

132. Evaluation of a pharmacist-managed asthma adherence and education program. *Sonia Mittal, Pharm.D.,* Rachel L. Couchenour, Pharm.D., BCPS, Kelly R. Ragucci, Pharm.D., BCPS; Medical University of South Carolina, Charleston, SC.

PURPOSE: Active pharmacist interventions can positively affect outcomes and quality of life, and decrease total health care costs of asthma. This report describes the development and implementation of a pharmacist-managed asthma education and adherence program.
DEVELOPEMENT: Three ambulatory clinics are involved with this program. Policies and procedures were written by clinical pharmacists and approved by medical directors at each site. A statistician was consulted before implementation to assure that the data gathered would allow assessment of the economic and quality of life impact of the program.
The program consists of seven sessions with the clinical pharmacists over a 6-month period. Before implementation, a quality of life assessment tool, educational devices, and handouts were selected. Additionally, data collection forms were designed.
IMPLIMENTATION: Each clinic will initially enroll 20 participants into the program. Primary care physicians at each site have been encouraged to refer potential patients. Eligible participants include those with a diagnosis of asthma and a perceived ability to self-manage their disease state. Session one consists of baseline assessments of demographics, asthma therapy, peak flow measurements, and quality of life. Session two primarily focuses on education tailored for each individual participant. Sessions three through six are conducted over the phone and focus on adherence. In the final session, quality of life, peak flow measurements, and asthma therapy will be reevaluated.
CONCLUSION: The enrollment process for the program is currently ongoing at one of the three clinics. Overall, the program has been well received by other health care professionals as well as the patients.

133. A clinical pharmacist's role in assessing and dispensing methadone for medical maintenance treatment. *Sonja J. Kapitan, MPH,* Asaad B. Awan, Pharm.D., Cathy M. McDonald; University of Washington, Seattle, WA.

PURPOSE: To describe the features, feasibility, and outcomes associated with clinical pharmacy assessment and dispensement of methadone for medical maintenance treatment in a primary care setting. To serve as a medical model for future methadone maintenance programs.
METHODS: A descriptive evaluation to characterize the role of clinical pharmacy in the implementation of a methadone maintenance program. Thirty methadone-stable patients were enrolled to receive assessment with dispensement of methadone from clinical pharmacists. Policies, mechanisms, and procedural forms capturing drug accountability, clinical assessment of methadone stability, compliance with dispensement of 10 mg methadone tablets, and patient satisfaction were studied. Feasibility was captured through time motion study of methadone maintenance processing features.
RESULTS: Six-month data revealed 90% of patients were retained as based on attendance to clinical pharmacy appointments. From 148 samples collected, 0.7% of patient urine specimens were assessed to be positive for illicit drug use. The mean ± SD methadone dose dispensed was 70 ± 30 mg/day with patients receiving up to a 4-week supply. The mean ± SD duration for a clinical pharmacy appointment was 12 ± 5.1 minutes, and the mean ± SD time to process a patient prescription was 4.4 ± 2.7 minutes.
CONCLUSIONS: Services provided by clinical pharmacy for methadone maintenance treatment were found not only to be feasible but also reimbursed. A clinical pharmacist may better enable patients to reintegrate into society through improved patient confidence and decreased psychosocial stigma. Assessment by clinical pharmacy provides continuous monitoring of stable patients and more rapid intervention for treatment of unstable patients.

134. Patient perception of pharmacist counseling during osteoporosis screening. *Laura M. Borgelt, Pharm.D.,* Todd Addington, Pharm.D.; University of Colorado Health Sciences Center, Denver, CO; Shenandoah University, Winchester, VA.

PURPOSE: The purpose of this study was to evaluate patient satisfaction with pharmacist counseling and impact on calcium and vitamin D use during an osteoporosis screening at a family medicine clinic.
METHODS: Thirty-six patients were surveyed regarding osteoporosis risk factors and current medication use. After a heel ultrasound, a pharmacist or pharmacy student counseled (verbally and in writing) patients about osteoporosis, risk factors, results of the test, and appropriate calcium and vitamin D intake. Patients were asked to evaluate their satisfaction with counseling on a scale of 1 to 5 (poor to excellent). Two weeks after the interaction, patients were called to determine if recommendations for calcium and vitamin D use were accepted.
RESULTS: Patients expressed high satisfaction with pharmacy services by selecting a rating of 4 or 5 in all categories surveyed; 31/36 (86%), 32/36 (89%), 35/36 (97%) rated a 5 for written information, verbal communication, and overall satisfaction, respectively. Pharmacists also made an impact on calcium and vitamin use. In osteopenic patients, calcium and vitamin D use increased from 22.2% to 77.8% after pharmacy counseling. In osteoporotic patients, calcium and vitamin D use increased from 42.8% to 100% after pharmacy counseling. In patients with normal bone mineral density, pharmacy counseling had no impact on calcium and vitamin D use.
CONCLUSIONS: Pharmacist counseling can have a major impact on patients during osteoporosis screenings. Patients in this study were highly satisfied with pharmacy services and responded positively to calcium and vitamin D recommendations.

135. Development of an osteoporosis screening program in a large health care system. *Craig D. Logemann, Pharm.D., BCPS,* Annette M. Brand, Pharm.D.; Partners in Health Clinics, Des Moines, IA.

PURPOSE: To establish an osteoporosis screening program from a family medicine residency program clinic.
METHODS: The pharmacy staff in a family medicine residency program was instrumental in designing an osteoporosis management plan for the clinic. The staff was involved in the selection of a dual-energy X-ray absorptiometry (DEXA) device. An ultrasound heel bone density screening device was used at multiple locations within the metro area. Various health system affiliates (wellness center, senior center, and primary care clinics) collaborated in conducting screenings at malls, work sites, and clinics. During the first 6 months of the program, 20 screening events were conducted with about 800 people tested. The pharmacy staff coordinated the screenings and counseled patients about their test results. Various osteoporosis-related educational tools were incorporated into the program.
CONCLUSION: Pharmacists can become involved in a primary care setting to help identify patients at risk for osteoporosis. Collaboration with various health system affiliates can enhance the potential for generating patient contacts and clinic revenue.

136. Assessing and advising women for breast cancer risks and treatment options. *Sara L. Noble, Pharm.D.,* Debbie S. King, Pharm.D., Janet Price, D.O., Deidre M. Phillips, M.D., Kristopher Harrell, Pharm.D., William H. Replogle, Ph.D.; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: A survey was conducted in the family medicine clinics to assess women's breast cancer risk and to help in determining how to advise them.
METHODS: During the summer of 2000, women in our two family medicine clinics were invited to be screened for their breast cancer risks. A survey to assess breast cancer risk was developed based on the Gail Model Risk Assessment Tool. The data collected were input into the Gail Model Risk Assessment Calculator. Information was also collected on a health risk survey pertaining to current use/length of hormone replacement therapy. Family medicine faculty and residents were informed before the patient encounter of patients' risk status. Family medicine faculty and residents were given instruction for appropriate counseling with high-risk patients. Benefits and risks of tamoxifen and raloxifene were also included in the counseling session. Women whose 5-year breast cancer risk was ≥ 1.67 were identified and counseled. Women meeting inclusion criteria for the National Surgical Adjuvant Breast and Bowel Project's Study of Tamoxifen and Raloxifene study received information and contact numbers. All women received counseling for breast cancer screening.
RESULTS: A total of 209 patients were screened during the 2-month period. Thirty-six high-risk patients (17%) were identified and received counseling.
CONCLUSION: It is important that women be screened and counseled appropriately for breast cancer risk status. Women identified for this high risk were given the opportunity through pharmacists' and physicians' collaborative efforts to be a part of a national trial for breast cancer prevention.

Student, Resident, Fellow Research in Progress

These papers describe original research by students, residents, and fellows in therapeutics, pharmacokinetics, pharmacodynamics, pharmacoeconomics, pharmacoepidemiology, and pharmacogenomics in which the research effort is still on-going. The abstract title and authors are published in *Pharmacotherapy*; the full abstract will be published in the meeting program book.

137. Pretreatment with thienopyridines improves safety profile of patients undergoing intracoronary stenting. *Sabine E. Heitz, Pharm.D.*, Barry R. Rutherford, M.D., Mark Woods, Pharm.D., FASHP, Michael M. Coen, M.A., MBA, Steven P. Marso, M.D.; Mid America Heart Institute, Kansas City, MO.

138. Evaluating compliance to inotropic selection guidelines in heart failure patients. *Katherine M. Greenlee, Pharm.D.*, Kerry K. Pickworth, Pharm.D., Sondra J. Sierawski, B.S.; The Ohio State University Medical Center, Columbus, OH.

139. African Americans with heart failure experience lower quality of life and higher resource utilization compared to Caucasians. Grace P. Shin, Pharm.D., *Joseph F. Tooley, Pharm.D.*, Mary Ross Southworth, Pharm.D., Stephanie Dunlap, D.O., J. Gregory Boyer, Ph.D., Nelda Johnson, Pharm.D.; University of Illinois at Chicago, Chicago, IL; Pharmacia Corporation, Skokie, IL.

140. The renin angiotensin system in myocardial ischemia/reperfusion injury. *Jeremy D. Flynn, Pharm.D.*, Prakash Narayan, Ph.D., Wendell S. Akers, Pharm.D., Ph.D., BCPS; University of Kentucky Chandler Medical Center, Lexington, KY.

141. The transition from inpatient to outpatient antibiotic therapy at a university teaching hospital. *Arshad M. Qureshi, B.S., Pharm.D. candidate*, Sheryl L. Follin, Pharm.D., BCPS, Alexandra E. Hilts, Pharm.D.; University of Colorado Health Sciences Center; University of Colorado Hospital, Denver, CO.

142. Evaluation of calcium nutrition and impact of health care practitioner counseling on calcium intake in pregnant women. *Valery L. Chu, Pharm.D.*, Judy W.M. Cheng, Pharm.D., BCPS, Jan I. Maby, D.O.; San Francisco General Hospital, San Francisco, CA; University of California at San Francisco, San Francisco, CA; Mount Sinai Medical Center, New York, NY; Arnold & Marie Schwartz College of Pharmacy and Health Sciences, Brooklyn, NY; Cobble Hill Health Center, Brooklyn, NY.

143. A pharmacokinetic evaluation of mycophenolate mofetil after cadaveric kidney transplantation. *Michel LeBlanc*, Ghislain Bérard, Gilles St-Louis, Bernard Vinet, Marie-Claude Guertin, Pierre Daloze, Christian Smeesters, Michel Paquet, Michel Lallier, Jean-Louis Brazier, Stéphan Busque; University of Montréal; Notre-Dame Hospital, PQ, Canada.

144. Prevention of reperfusion hemorrhage after ischemic stroke. *Chris M. Jacobs*, Susan C. Fagan, Pharm.D.; University of Tromso, Tromso, Norway; University of Georgia, Augusta, GA; Medical College of Georgia, Augusta, GA.

145. Comparison of internist- vs cardiologist-assisted management of heart failure in a university-based internal medicine clinic. *Renee Sprik, Pharm.D.*, Robert Lee Page, II, Pharm.D., J. Mark Ruscin, Pharm.D., BCPS; University of Colorado Health Sciences Center, Denver, CO.

146. Prevalence of potentially interacting therapeutic pharmaceuticals in diagnostic renal imaging. *Christopher Janik, B.S.*, Christopher Nde, Pharm.D., Syed Sajid Hussain, M.D., Edward M. Bednarczyk, Pharm.D.; State University of New York at Buffalo, Buffalo, NY.

147. A high-density and low-density lipoprotein cholesterol comparison between simvastatin and atorvastatin therapy. *Martha A. Aldridge, Pharm.D.*, Matthew K. Ito, Pharm.D., FCCP, BCPS; University of the Pacific, Stockton, CA; VA San Diego Healthcare System, San Diego, CA.

148. Antibiotic resistance patterns before and after formulary restriction of third-generation cephalosporins. *Kerry M. Empey, Pharm.D.*, Robert P. Rapp, Pharm.D., BCPS, FCCP, Martin E. Evans, M.D.; University of Kentucky, Lexington, KY.

149. Evaluation of fluoroquinolone usage at a university teaching hospital. *Bradi Jones, Pharm.D. candidate*, Cindy Mascarenas, Pharm.D. candidate, David S. Burgess, Pharm.D.; University of Texas, Austin, TX; University of Texas Health Science Center, San Antonio, TX.

150. Evaluation of the effectiveness of cytomegalovirus prophylaxis in kidney transplant recipients. *Daniele K. Gelone, Pharm.D.*, Kinnari S. Shah, Pharm.D. candidate, Julie Arndorfer, MPH, Alan B. Leichtman, M.D., Kathleen D. Lake, Pharm.D.; University of Michigan Medical Center, Ann Arbor, MI.

151. The impact of the RALES study on spironolactone use among congestive heart failure patients in a Medicaid managed care organization. *James Hoffman, Pharm.D.*, Ingrid C. Freeny, Pharm.D., Amy L. Phillips, Pharm.D., Olufemi Paul, R.Ph., Michael Schaffer, Pharm.D., MBA; University of the Sciences Philadelphia; Thomas Jefferson University; Health Partners, Philadelphia, PA.

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