ABSTRACTS

American College of Clinical Pharmacy
2003 Spring Practice and Research Forum/
Updates in Therapeutics
April 27–30 ▪ 2003
Riviera Resort and Racquet Club
Palm Springs ▪ California

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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 2003 Spring Practice and Research Forum/Updates in Therapeutics. 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. The effects of continuous tube enteral feedings on phenytoin serum concentrations in long-term care residents. *Antonia Alafris, B.S., Pharm.D., CGP*, Subtle Burney, M.D., Audrey Morgan, R.N., William Polombo, R.D., Henry Cohen, B.S., M.S., Pharm.D., BCPP, CGP; Kingsbrook Jewish Medical Center, Brooklyn, NY.

PURPOSE: To observe the effects on phenytoin serum concentrations after spacing the administration of continuous enteral feedings from the administration of phenytoin suspension in long-term care residents.
METHODS: Thirty-five residents taking phenytoin suspension concomitantly with continuous enteral feeds were included in the study. Demographic data, phenytoin and albumin serum concentrations, and creatinine clearance were collected at baseline. Then, continuous tube feedings were stopped 1 hour before and 1 hour after each phenytoin dose and the feeding tubes were flushed with ≥ 30 ml of water before and after each phenytoin administration. Two weeks later, serum concentrations of the anticonvulsant were collected.
RESULTS: Twenty-eight patients completed the study. The mean phenytoin serum concentration at baseline, and at 2 weeks, was 13 mg/dl (range: 0.86-36.5 µg/ml; 6 patients > 20 µg/ml) and 21.2 mg/dl (range: 4.7-63.1 µg/ml; 13 patients > 20 µg/ml), respectively. Phenytoin concentrations significantly increased in 22/28 residents from 12.4 µg/ml (range: 0.86-36.5 µg/ml; 4 patients > 20 µg/ml) to 23.7 µg/ml (range: 4.7-63.1 µg/ml; 11 patients > 20 µg/ml), (p=0.001) and decreased in 6/28 patients from 15.1 mg/dl (range: 8.4-26.4 µg/ml; 2 patients > 20 µg/ml) to 12.2 mg/dl (range: 5.5-25.1 µg/ml; 2 patients > 20 µg/ml; p>0.05).
CONCLUSIONS: Phenytoin serum concentrations significantly increased after the spacing of enteral feedings from each phenytoin dose. We suggest that patients who are to receive continuous enteral feedings and phenytoin suspension should have the enteral feeds stopped 1 hour before and 1 hour after each phenytoin dose to minimize the magnitude of this interaction.

2. Anaphylactic reaction to a dietary supplement containing willow bark. Joseph Boullata, Pharm.D., BCNSP, *Patrick J. McDonnell, Pharm.D.*, Cynthia Oliva, A.S.; Temple University, Philadelphia, PA.

OBJECTIVE: To describe a probable association between the use of a dietary supplement containing willow bark and anaphylaxis in a patient allergic to aspirin.
CASE REPORT: A 25 year old woman presented to the ED with diffuse pruritis, urticaria on her face and feet, hypotension, dyspnea and edema of her hands, eyes, lips, nose and pharynx. The patient had first noticed symptoms about 75 minutes after ingesting 2 capsules of Stacker 2 (NVE Pharmaceuticals, Inc. Newton, NJ), a dietary supplement. Her vital signs at presentation included a temperature of 95.7°F, BP 60/40, HR 104, and RR 20. Initial treatment included diphenhydramine 25 mg IV, 2 L of NSS, epinephrine 0.3 mg IV, and methylprednisolone 125 mg IV. Past medication history includes salmeterol, fluticasone, and albuterol MDIs for asthma, paroxetine, and oral contraceptives. Allergy history is significant for aspirin and latex, both manifested with hives and shortness of breath. The patient was admitted to the ICU and supportive treatment continued. The patient was discharged the following day with no acute respiratory distress.
DISCUSSION: Dietary supplements containing various botanical ingredients, continue to be used by large numbers of people. This case of anaphylaxis is most likely related to willow bark extract of the ingested dietary supplement with a documented allergy to aspirin. Salicin, the principal active ingredient of willow bark lead to the introduction of acetyl salicylic acid (aspirin). It has been suggested that willow bark containing dietary supplements should be avoided in patients with reactions from salicylates, although no allergic reactions in patients has been reported until now.
CONCLUSIONS: Suggest cautioning patients with any history of aspirin allergy to avoid willow bark-containing dietary supplements. Until such time as these products are each required to document safety prior to marketing, it continues to be the responsibility of health care providers to identify and report suspected adverse effects associated with dietary supplements.

Analgesia

3. Time course of symptom relief with various anti-migraine therapies. *Alison C. Lyke, Pharm.D.*, Susan E. Spruill, M.S., Diane E. Littlefield, R.N., MSN, John R. Plachetka, Pharm.D.; POZEN, Inc., Chapel Hill, NC.

PURPOSE: The symptoms of migraine not only include pain, but also the associated symptoms of nausea, photophobia, and phonophobia. Little is known about the natural progression of these symptoms and how various anti-migraine therapies may affect them differently. We performed an analysis of the percentage of patients with pain, nausea, photophobia, and phonophobia over time with 5 anti-migraine therapies as compared to placebo.
METHODS: Data from double-blind, randomized, placebo-controlled clinical trials in migraine patients treated with an oral NSAID, sumatriptan, combination NSAID and sumatriptan, combination NSAID and antiemetic, or subcutaneous dihydroergotamine were included in this retrospective analysis. Patients were allowed to rescue at 2 or 4 hours post-dose. Response to each therapy was compared over time for each migraine symptom.
RESULTS: The percentage of patients with symptoms decreased over the first 2 hours post-dose in the placebo group, and then either plateaued (pain, photophonia, phonophobia) or increased (nausea) from 2 to 4 hours. With active treatment the percentage of patients with symptoms decreased at a faster rate than placebo from baseline to 4 hours, with the exception of nausea, which tended to plateau after 2 hours in the NSAID, sumatriptan, and combination NSAID and antiemetic groups. The greatest response in all symptoms at 4 hours was seen in the group treated with a combination of sumatriptan and an NSAID, followed by dihydroergotamine or sumatriptan alone.
CONCLUSIONS: Combination therapy, specifically with sumatriptan and an NSAID, produces the fastest and greatest relief of both migraine pain and the associated symptoms of nausea, photophobia and phonophobia during the 4 hours post-treatment.

4. Improved outcomes in patient-controlled analgesia through failure modes and effects analysis. *Anthony T. Gerlach, Pharm.D.*, Ariane K. Schieber, Pharm.D., Harrison G. Weed, M.D.; Ohio State University Medical Center, Columbus, OH.

PURPOSE: Patient controlled analgesia (PCA) can provide superior pain relief in many circumstances, but also presents risks as a novel method of administering opiates. Both the Institute of Safe Medication Practices and the Joint Commission for Accreditation of Healthcare Organizations have identified PCA as a high-risk process. We undertook a formal analysis to identify and reduce the risks of PCA.
METHODS: We used Failure Modes and Effects Analysis (FMEA) to analyze the process of PCA. FMEA entails forming a team composed of people involved in every stage of the process, explicitly flowcharting the process, ranking the steps, or modes of the process for their potential failure and for patient harm, and changing the process to reduce risk of patient harm. We used Fisher's exact test to analyze outcomes
RESULTS: We identified four steps in the PCA process as most likely to cause patient harm: medication selection, medication ordering, communication/documentation, and pump management/maintenance. We took five specific actions: limit/standardize medication/concentration choice, simplify/standardized pump programming, enlarge lettering and color code syringe labels, standardize bolus dosing procedure, location and content of documentation, use of pump locks, and pump maintenance. Before implementation 4.7% (26/549) of PCA orders were placed from standard order sets. After implementation 88.6% (250/282) of PCA orders were placed

from standard order sets ($p<0.0001$). We are continuing education efforts and follow-up analysis.
CONCLUSIONS: Failure Modes and Effects Analysis can significantly improve patient care processes, as demonstrated by applying FMEA to the process of Patient Controlled Analgesia.

Cardiology

5. Outcomes of antiarrhythmic drug therapy in patients with systolic heart failure and atrial fibrillation. *Kerry A. Stiegler, Pharm.D.,* Amy M. Franks, Pharm.D., Mark C. Granberry, Pharm.D., Jason B. Hawkins, Pharm.D., Eugene S. Smith, M.D.; University of Arkansas for Medical Sciences, Little Rock, AR; The University of Texas, Pan American, Edinburg, TX; University of Texas, Austin, TX; Central Arkansas Veterans Healthcare System, Little Rock, AR.

PURPOSE: Current heart failure (HF) treatment recommendations state that amiodarone is the preferred drug when antiarrhythmic therapy is indicated for the treatment of supraventricular arrhythmia, however no comparative trials exist to support these recommendations. The objective of this study is to determine the rate of death and hospitalizations of HF patients with atrial fibrillation (AF) treated with amiodarone versus other anti-arrhythmics.
METHODS: Computer records from a university-affiliated Veterans Affairs teaching hospital were used to retrospectively evaluate the combined risk of death and hospitalizations for HF during antiarrhythmic drug therapy in patients with systolic HF and concurrent AF. Patients were identified based on ICD-9 codes and were subdivided into two groups, amiodarone-treated patients (group A), and those treated with sotalol, quinidine, or procainamide (group B). Outcomes were evaluated using Cox proportional hazards regression.
RESULTS: The study population consisted of 39 patients, 17 patients in group A and 22 patients in group B. There were 0.62 major events/1000 treatment days in group A versus 0.81 major events/1000 treatment days in group B ($p=0.52$). The two groups were similar with respect to ejection fraction, age, and comorbid diseases. HF drug therapy was also similar, except significantly more group A patients received β-blocker therapy.
CONCLUSIONS: The combined risk of death and hospitalizations in HF patients with AF who received amiodarone versus those who received other Class III or Class I antiarrhythmic agents was similar. Further comparative study is warranted to evaluate if amiodarone is safer than other antiarrhythmic agents in systolic HF patients with AF.

6. Incidence of hyperkalemia in chronic heart failure patients taking spironolactone in a VA medical center. *Eric W. Weber, Pharm.D., BCPS,* Catherine Marsh, Pharm.D., Michelle Wilhardt, Pharm.D.; Carl T. Hayden VA Medical Center, Phoenix, AZ; Fletcher Allen Healthcare, Burlington, VT.

PURPOSE: This study retrospectively assessed the incidence of hyperkalemia in CHF patients receiving spironolactone in a federal outpatient setting. While the recently published RALES trial found a low incidence of hyperkalemia in CHF patients receiving spironolactone therapy, our hypothesis was that hyperkalemia risk may be higher outside of the research environment where patient monitoring is less rigorous.
METHODS: Patients diagnosed with CHF who were started on spironolactone between January 1, 1999 and December 31, 2001 were included in the study. Using a Computerized Patient Records System (CPRS), serum potassium levels were assessed at baseline and throughout spironolactone treatment to identify cases of hyperkalemia, analyze trends in potassium levels from baseline, and evaluate monitoring frequency.
RESULTS: Of 171 patients, 33 % had hyperkalemia ($K^+ \geq 5.4$ mmol/L), while the rate of serious hyperkalemia ($K^+ \geq 6$ mmol/L) was 13%. Adherence to the VA guideline regarding potassium monitoring was 25%.
CONCLUSIONS: The incidence of serious hyperkalemia found in this study population was higher than that reported by the RALES investigators (13% vs 2%). Higher spironolactone doses and renal insufficiency coincided with a higher incidence of serious hyperkalemia. CHF patients may be at a greater risk for the development of hyperkalemia when treated with spironolactone outside of a research environment. Monitoring recommendations should be followed to maximize patient safety, particularly in patients with renal insufficiency or in those receiving higher spironolactone doses.

7. Retrospective analysis of niacin extended-release usage in diabetic patients. *Yong S. K. Moon, Pharm.D.,* Lily Nguyen, Pharm.D., Moti L. Kashyap, M.D.; University of the Pacific, Stockton, CA; VA Long Beach Health Care System, Long Beach, CA; University of California, Irvine, CA.

PURPOSE: Although niacin can correct lipid abnormalities commonly found in diabetic patients, it has been relatively contraindicated due to reports of glucose intolerance. This study reviewed the use of niacin extended-release (ER) among diabetic veterans to determine its effect on glycemic control and lipid profile.
METHODS: Electronic chart review was conducted on all diabetic patients receiving niacin ER from 8/99 to 4/01 at the VA Long Beach Health Care System. Lipid profiles, HgA_{1c}, glucose, and AST/ALT were compared at baseline and 9-10 months. Reasons and rate of niacin ER discontinuation were examined.
RESULTS: Out of 103 subjects identified, 86 patients had sufficient data for evaluation. Average dose of niacin used was 1223 mg. Baseline lipid profile, glucose, HgA_{1c} were as follows: total cholesterol 209 mg/dl, LDL cholesterol 122 mg/dl, HDL cholesterol 36 mg/dl, triglycerides 366 mg/dl, glucose 160 mg/dl, HgA_{1c} 7.7%. Niacin ER was discontinued in 15% of patients due to flushing/rash and in 9% due to glucose intolerance. After 9-10 months of treatment, total cholesterol, HDL cholesterol, and triglycerides levels changed significantly by –10%, +19%, and –33%, respectively ($p<0.05$). Change of –8.2% in LDL cholesterol was not statistically significant. HgA_{1c} decreased by 9.7% ($p<0.05$). There were no significant changes in glucose and AST/ALT levels.
CONCLUSIONS: This retrospective analysis indicates that majority of diabetic patients can tolerate niacin ER without loss of glycemic control, and therefore should be considered in diabetic patients with elevated triglycerides and/or low HDL cholesterol.

8. Low myositis rates associated with use of dyslipidemic agents in a group model HMO. *Roberta L. Shanahan, Pharm.D.,* Jane A. Kerzee, Pharm.D., BCPS, Brian G. Sandhoff, Pharm.D., BCPS, John A. Merenich, MD; Kaiser Permanente, Westminster, CO; Kaiser Permanente, Longmont, CO; Kaiser Permanente, Lakewood, CO; Kaiser Permanente, Denver, CO.

PURPOSE: Statins as sole therapy for patients with dyslipidemia rarely cause severe myositis. However, the risk of myositis increases when statins are used in conjunction with fibrates and/or other interacting agents but the true incidence is unclear. Utilizing data from Kaiser Permanente of Colorado (KPCO), a group model HMO with 400,000+ members, we assessed the rate of myositis and compared this to dyslipidemic agent use over time.
METHODS: KPCO data systems were queried for all patient's with possible myositis (hospital diagnosis of myositis or any CPK >1,000 IU/L) or use of dyslipidemic agents over a five year period. Myositis cases with concomitant use of statins, alone or in combination with a fibrate and/or other interacting medication were identified. Cases were excluded if medical record review did not confirm the coded diagnosis.
RESULTS: We identified 580 patients with myositis and 392,118 prescriptions for a statin or fibrate. There were 62 patients with myositis who were exposed to dyslipidemic agents within 4 months of their event. Of these, 17 (3 monotherapy, 8 statin/fibrate combinations, 6 statin + other agents) had documented CPK elevation and no other obvious clinical etiology (e.g. falls). Year to year incidence of myositis increased over the five year period, from 0.15 to 0.91/1000 patients, but was proportionate to the overall increase in dyslipidemic agent use ($p=0.3886$).
CONCLUSIONS: The number of myositis cases associated with dyslipidemic agents is relatively low (<1%). In a system with adequate counseling and routine monitoring, practitioners can safely utilize combination therapy for dyslipidemia.

9. Evaluating clinical outcomes for subjects that are newly started on HMG-CoA reductase inhibitors in a naturalistic environment. *Mark J. Cziraky, Pharm.D.,* Vincent J. Willey, Pharm.D., Ibrahim S. Al-Zakwani, M.S., Michael F. Bullano, Pharm.D., Louise A. Graham, MHSA, John C. Corbelli, M.D.; Health Core, Inc., Newark, DE; Pfizer, Inc., New York, NY; Buffalo Cardiology and Pulmonary Associates, Buffalo, NY.

PURPOSE: To evaluate lipid level changes, NCEP-ATPIII LDL-C goal attainment, time to goal, and adherence to therapy among patients using one of four cholesterol-lowering drugs.
METHODS: Patients were included if they began atorvastatin, simvastatin, fluvastatin, or pravastatin therapy between 7/1/1999 and 12/31/2000, and had no statin therapy in the previous 6 months, continuous health plan enrollment 6 months pre-index and 12 months post-index, and post-index lipid measurements. Ordinary least square, logistic regression, and cox proportional hazard analyses were employed for data evaluation. Model covariates included age, gender, NCEP-ATPIII risk status, duration of statin therapy, medication possession ratio (MPR), dose change rate, baseline lipid profile, and time to first LDL-C measurement. Since treatment guidelines were revised during the follow-up period, the newer, more stringent (NCEP-ATPIII) were used.
RESULTS: A total of 11,472 patients were studied (atorvastatin = 5,351; fluvastatin = 870; pravastatin = 1,427; simvastatin = 3,824). Mean duration of therapy was 16 ± 8 months; adherence to therapy (MPR) was 77%; average daily doses were: atorvastatin = 14 ± 8mg; fluvastatin = 34 ± 12mg; pravastatin = 27 ± 10 mg; simvastatin = 24 ± 13 mg. Atorvastatin had significantly greater percentage reductions than fluvastatin, pravastatin, and simvastatin in total cholesterol (-24%, -14%, -15%, -21%, respectively), LDL-C (-32%, -20%, -22%, -29%, respectively), and triglycerides (-13%, -3%, -1%, -6%, respectively). No significant beneficial differences in HDL-C were observed. Probabilities of achieving LDL-C goal and mean times to goal were: fluvastatin (0.40, 560 days); atorvastatin (0.72, 201 days); pravastatin (0.47, 486 days); simvastatin (0.66, 216 days).
CONCLUSIONS: Patients prescribed atorvastatin had significantly greater

improvements in total cholesterol, LDL-C, and TG, and attained LDL-C goal significantly more often and in a shorter period of time.

10. Assessment of blood pressure control in therapeutic interchange program when converting from extended-release nifedipine (nifedipine XL) to amlodipine in an inpatient setting. *John A. Dougherty, MBA, Pharm.D.*, Peter Dumo, Pharm.D., Angela J. Milad, R.Ph., Mousumi Banerjee; Harper University Hospital; Wayne State University, Detroit, MI.

PURPOSE: In October 2000, an inpatient automatic therapeutic interchange (TI) program was implemented, converting patients from nifedipine XL to amlodipine. This study evaluated the effects of an inpatient dihydropyridine (DHP) calcium-channel blocker (CCB) TI program. The primary endpoints of this study were blood pressure (BP) control and discharge CCB.
METHODS: Medical records for 409 patients met criteria and were reviewed for the control group (nifedipine XL pre-interchange) and the intervention group (amlodipine post-interchange). BP was recorded for the first 24 hours prior to TI and up to 72 hours post TI. Information on rescue medications given, concomitant anti-hypertensives, and discharge medications were recorded. Statistical analysis using unpaired t-test compared systolic and diastolic blood pressures (SBP and DBP).
RESULTS: Mean SBP and DBP 24 hours post TI decreased 7.93 mm Hg and 4.32 mm Hg in patients not undergoing TI, compared to a decrease of 1.11 mm Hg and 0.47 in patients undergoing TI ($p<0.016$ for both). Similar numbers of rescue medications were used between groups. Fifteen percent of patients switched to amlodipine were discharged on amlodipine.
CONCLUSIONS: Patients that underwent TI for DHP CCB resulted in a statistically significant difference in BP control compared to patients who did not undergo substitution. These changes in BP, however, are unlikely to be of clinical significance. An inpatient DHP CCB TI program did not result in increased patient risk of uncontrolled hypertension based on no difference in numbers of hypertensive crises between groups. Most patients were maintained on nifedipine XL on discharge.

11. Nesiritide in the management of congestive heart failure: a retrospective study of hemodynamics and adverse events in a community teaching hospital. *Saeed Rasty, Pharm.D.*, Sirajuddin Mohammed, M.D.; Advocate Christ Medical Center, Oak Lawn, IL.

Nesiritide (NTD) is a synthetic brain natriuretic peptide and is promoted as a new therapy for decompensated congestive heart failure (CHF).
PURPOSE: To assess the hemodynamics and adverse effects of NTD in CHF patients admitted to the hospital.
METHODS: Medical records of 40 CHF patients were evaluated retrospectively.
RESULTS: Our patients average (AVG) age was 76 (14) years ,most had significant past history (HX) for CHF, CAD, DM, CRF, A.fib, HTN while 45% had HX of COPD. All patients reported dyspnea and most presented with rales and edema in the ER and represented with class III and IV NYHA . The AVG heart rate and blood pressures were 75 (18), SBP 127 (22) mm Hg and DBP 69 (13)mm Hg at time of admission. AVG serum creatinine of 2.2 (1.1) mg/dl and BNP of 948 (389) pcg/ml was reported. NTD was given as a bolus dose of 2µg/kg and fixed dose of 0.01 µg/kg/minutes, the AVG length of infusion was 62 (36) hours and diuretics were used in 90% of cases. 9 cases received inotropes and vasopressors concomitantly. We performed repeated measure ANOVAs on the blood pressure data during the NTD infusion. Over the first 48 hours there was significant changes in both systolic (SBP48HR=118mm Hg, $p=0.001$) and diastolic (DBP48HR=64mm Hg, $p=0.044$) blood pressures. 12 of our patients suffered from non-sustained ventricular tachycardias (NSVT) while on NTD, of whom 2 had a prior Hx of NSVT.
CONCLUSIONS: In our patient population, significant drop in BP was seen and high number of NSVTs were reported.

12. A systematic review of the relationship between microalbuminuria and cardiovascular events in patients with hypertension and diabetes. *Hayley Y. Park, Pharm.D.*, Glen T. Schumock, Pharm.D., MBA, Simon A. Pickard, Ph.D., Kasem S. Akhras, Pharm.D.; University of Illinois, Chicago, IL; Pharmacia Corporation, Skokie, IL.

PURPOSE: To estimate the risk of cardiovascular (CV) events associated with presence of microalbuminuria in patients with both diabetes and hypertension.
METHODS: A systematic review of randomized-controlled trials published January 1990 - February 2002 was conducted using MEDLINE, IPA, and CINAHL. Keywords and MeSH terms for hypertension and diabetes were combined. All studies reporting microalbuminuria and CV events were selected for further review. Study information of interest included study design, patient demographics and risk factors, treatment regimens, and outcomes variables. Relative risks (RRs) and odds ratios (OR) were used when reported, otherwise were calculated from data provided in results.
RESULTS: Of 592 citations initially screened, 68 articles were selected for full review. Only one study met all original inclusion criteria. Consequently, five additional studies that reported hypertension in greater than 50% of patients with diabetes were included. Cardiovascular-related endpoints included stroke, Myocardial Infarction, Congestive Heart Failure, all cause mortality, and composite CV morbidity. No risk estimates were reported for stroke, MI, or CHF. Presence of microalbuminuria (Yes or No) was associated with higher risk of all cause mortality (ORs: 2.60 to 5.95; RR: 1.60 to 7.92). Lack of homogeneity between studies precluded pooling of results for meta-analysis.
CONCLUSIONS: Microalbuminuria is associated with significant increase in mortality in patients with diabetes and hypertension. Further studies of the relationship between varying levels of microalbuminuria and CV events in patients with diabetes and hypertension are needed for greater insight into the potential benefits of pharmacotherapies that reduce levels of microalbuminuria.

13. ACE inhibitor therapy reduces ACE enzyme activity in pericardial fluid independent of dose. *Craig D. Williams, Pharm.D.*, Keith March, M.D., Ph.D., Anne Nguyen, M.S., Toby Zirkle, B.S., Cindy Calley, M.A.; Purdue University; Indiana University, Indianapolis, IN.

PURPOSE: This study measured ACE enzyme activity in serum and pericardial fluid in patients on different doses of ACE inhibitors and in pericardial fluid only of patients not on ACE inhibitors to determine 1) the effects of systemic ACE inhibition on cardiac ACE activity as measured in pericardial fluid 2) if the effects on pericardial fluid ACE activity correlate with the effects on serum ACE activity and 3) if the effects on pericardial fluid ACE activity are dose dependent.
METHODS: Pericardial fluid was collected from 14 patients on an ACE inhibitor and 14 patients not on an ACE inhibitor at the time of first pericardial sac rupture for open heart surgery. Serum samples were also collected from the patients on ACE inhibitor therapy. Activity of ACE enzyme was determined using a Sigma-Cobas diagnostic kit which has a reportable range of 5-120 U/L.
RESULTS: A statistically significant 63% reduction in ACE enzyme activity was observed in pericardial fluid in patients on an ACE inhibitor compared to patients not on an ACE inhibitor (median 13.5 u/L vs 5.0 U/L, Mann-Whitney $p<0.0001$). Higher daily doses failed to further reduce pericardial fluid ACE activity (median activity on 5 mg, 10 mg and 20 mg of <5.0 U/L, 5.0 U/L and <5.0 U/L [Kruskal-Wallis $p=0.34$]). For patients on an ACE inhibitor, pericardial fluid ACE activity was significantly lower than serum ACE activity (median 5.0 U/L vs 8.5 U/L, Signed-ranks test $p=0.0483$) with no correlation between the two (Spearmans $r=0.02$, $p=0.95$).
CONCLUSIONS: ACE inhibitor therapy reduces ACE enzyme activity in pericardial fluid independent of serum ACE activity. Higher daily doses of ACE inhibitors fail to further reduce enzyme activity.

14E. Effect of nesiritide versus milrinone on patient outcomes in the treatment of acutely decompensated heart failure. *Daniel A. Lewis, Pharm.D.*, Nandkishore R. Gurram, M.D., Wendell S. Akers, Pharm.D., Ph.D., William T. Abraham, M.D.; University of Kentucky Medical Center, Lexington, KY.

Presented at the Annual Meeting of the American College of Cardiology, Chicago, IL, March 30-April 2, 2003.

15. The effect of digoxin and hawthorn on myocyte contractility. *Barry E. Bleske, Pharm.D.*; University of Michigan, Ann Arbor, MI.

The herbal literature suggests that there is a drug interaction between hawthorn and digoxin, however, this interaction is not well defined. Although recent data have shown that there is no significant pharmacokinetic interaction between these compounds, a pharmacodynamic interaction may still be apparent.
PURPOSE: To determine the effect of hawthorn to increase myocyte contractility in the presence of digoxin.
METHODS: Myocytes were isolated from hearts obtained from Sprague-Dawley rats by standard methods. Myocytes were placed in a perfusion bath and initially perfused with 1.8 mM calcium Tyrode's solution (B) followed by a 1 ng/ml digoxin solution (D) for 15 minutes and then a 1 ng/ml digoxin + 40 ug/ml hawthorn solution (D+H) for 15 minutes Contractility measurements were obtained from 5 cells at baseline and following each 15 minute perfusion. Cells were stimulated at a rate of 2 Hz and contractility was measured with a video-edge detection system (IonOptics). Data were analyzed by ANOVA and reported as mean and standard deviation.
RESULTS: The percent fractional shortening (FS% - a measure of contractility) was significantly increased following perfusion with D+H as compared to baseline or D alone ($p<0.02$). The FS% for B, D, and D+H were $5.8 \pm 4.0\%$ vs $7.5 \pm 4.5\%$ vs $12.5 \pm 4.7\%$, respectively.
CONCLUSIONS: These preliminary results suggest that there is a significant pharmacodynamic interaction between digoxin and hawthorn on myocyte contractility. Further studies are warranted to further define this interaction and its therapeutic implications.

16. An integrated dofetilide system approach for dofetilide use. *Aungkana Vichiendilokkul, Pharm.D., M.S.*, Alison Tran, Pharm.D., Eric Racine, Pharm.D., Trupti Mehta, Pharm.D., Randy Lieberman, M.D.; Wayne State University, Detroit, MI.

PURPOSE: Dofetilide is the newest addition to the antiarrhythmic armamentarium. The complexity of its utilization, including hospital and prescriber certification, potential drug interaction, monitoring of electrolytes and QT interval, patient education and enrollment to a single mail-order pharmacy and discharge preparation, have limited its wide acceptance in clinical practice. A systematic team approach to simplify the process is warranted and may promote its use.
METHODS: An integrated team approach was developed and implemented in an urban university hospital to ensure safety, simplify the process and create a seamless system for prescribers. To assess safety and feasibility of this system, prospective chart review of 40 consecutive patients receiving dofetilide between September 2000 and 2001 was performed during hospitalization, at 1-week and 1-month post discharge.
RESULTS: An Integrated Dofetilide System (IDS) was utilized in all patients receiving dofetilide, including pharmacist support, pre-printed order sets, daily monitoring, patient education and outpatient follow-up. Maintenance of sinus rhythm was maintained in 22 (65%) and 17 (50%) patients at 1 week and 1 month, respectively. Dofetilide was discontinued in 12 (30%) patients due to adverse effects and failure to therapy. Six patients (15%) experienced adverse effects, including QT prolongation (1), ventricular tachycardia (2), torsade de pointes (2), and acute renal failure (1).
CONCLUSIONS: The IDS was successfully implemented in a university-based urban hospital. Our experience to date showed comparable efficacy to those reported in randomized, controlled trials. However, incidence of arrhythmias appeared to be higher than reported in literature.

17. Evaluation of nesiritide use for acutely decompensated heart failure. *Aungkana Vichiendilokkul, Pharm.D., M.S.,* Alison Tran, Pharm.D., Arpita Patel, Pharm.D., Eric Racine, Pharm.D.; Harper University Hospital; Sinai-Grace Hospital; Detroit Medical Center, Detroit, MI.

PURPOSE: Nesiritide is indicated for treatment of acutely decompensated heart failure. Most common adverse effect is hypotension. It was recently approved at the Detroit Medical Center (DMC) and can be prescribed only to patients in the intensive care unit (ICU) or emergency department after diuretic therapy has been optimized. A medication use evaluation was conducted to assess the compliance to the DMC criteria and safety profile of nesiritide.
METHODS: Medical records of patients receiving nesiritide between March and September 2002 were reviewed. Data collection included location of initiation and administration, diuretic dose, and blood pressure measurement.
RESULTS: Twenty-two patients were evaluated. Nesiritide was initiated in the ICU in all patients. Mean diuretic dose prior to nesiritide use was furosemide 146 ± 104 mg/day. Nesiritide was administered at 2 µg/kg bolus, followed by 0.01 µg/kg/minutes for a mean of 34.8 ± 21.0 hours. Baseline systolic blood pressure was 128 ± 24 mm Hg. Hypotension was observed in seven patients (31.8%). Mean onset of hypotension was 14 hours and lasted 2.3 hours after discontinuation. The drug was permanently discontinued in 6 patients. One patient was restarted on nesiritide at the reduced infusion rate. The mean length of hospital stay was 13.9 days.
CONCLUSIONS: DMC criteria were followed for all patients. Incidence of hypotension was higher than reported in published literature. This may be explained by the severity of illness as noted by long length of stay. Further evaluation is warranted and appropriate patient selection is necessary for better utilization of nesiritide therapy.

18. The percentage of patients meeting NCEP ATP III LDL-C goal in a controlled clinical trial with extended-release lovastatin. John R. Crouse, III, M.D., *Vincent Brett, M.S., R.Ph.,* Robert M. Niecestro, Ph.D., Peter Lukacsko, Ph.D., Vladimir Penkrat, Lawrence T. Friedhoff, M.D., Ph.D.; Wake Forest University, Winston-Salem, NC; Andrx Labs, Inc., Hackensack, NJ.

PURPOSE: To determine the percentage of patients enrolled in a controlled trial of extended-release lovastatin (ERL) who met their low-density lipoprotein cholesterol (LDL-C) goal based on the third report of the National Cholesterol Education Program's Adult Treatment Panel (ATP III).
METHODS: Results were previously reported for a multicenter, randomized, double-blind, placebo-controlled, parallel group study that compared ERL (10, 20, 40, and 60 mg once daily for 12 weeks) to placebo in 169 hypercholesterolemic adults. Over 94% of patients taking 60 mg ERL achieved LDL-C goal based on ATP II criteria. New features of ATP III that modify LDL-C goal include: raising diabetes to level of CHD risk equivalent, use of Framingham 10-year CHD risk, and redefined level at which high-density lipoprotein cholesterol (HDL-C) is low (<40 mg/dl). Using baseline characteristics, we recalculated each patient's LDL-C goal based on ATP III criteria and compared their goals to LDL-C levels achieved at endpoint.
RESULTS: The percentage of patients who met ATP III LDL-C goal was 91%, 85%, 74%, 64%, and 6% in the ERL 60, 40, 20, 10, and placebo groups, respectively. For patients with ≤1 CHD risk factor, the percentage of patients who met goal was 100%, 100%, 93%, 89%, and 7%, respectively. For patients with ≥2 CHD risk factors and Framingham 10-year risk ≥20%, the percentage of patients who met goal was 88%, 83%, 69%, 42%, and 6%, respectively.
CONCLUSIONS: Based on re-analysis of clinical trial data, over 91% of patients met their ATP III LDL-C goal with the 60 mg dose of ERL.

19E. Variable antiplatelet response to aspirin: is once daily dosing sufficient for everybody? *James J. Nawarskas, Pharm.D.,* Joe R. Anderson, Pharm.D., Veena Raizada, M.D.; University of New Mexico, Albuquerque, NM.

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20. Bivalirudin use in patients undergoing percutaneous transluminary coronary angioplasty. *Robert A. Barcelona, Pharm.D.,* Kerry K. Pickworth, Pharm.D.; Ohio State University Medical Center, Columbus, OH.

PURPOSE: Therapy given to treat acute coronary syndromes is associated with increased bleeding. Our tertiary care center's transfusion rate has been determined to be 10.8% in patients undergoing percutaneous coronary intervention (PCI) and receiving IIb/IIIa inhibitors. Bivalirudin, a direct thrombin inhibitor, has a more direct action on clot bound thrombin, short half-life and may potentially decrease bleeding episodes. Therefore, guidelines for use of bivalirudin were established for use in patients with a high bleeding risk undergoing PCI. The purpose is to determine adherence to the guidelines and describe bleeding associated outcomes in patients receiving bivalirudin.
METHODS: A retrospective analysis was completed on all patients receiving bivalirudin from January 2002- October 2002. Data collected included demographics, adherence to established guidelines, dose and administration, pertinent laboratory data, transfusion requirements, concurrent anti-thrombotic therapy, and length of stay (LOS). Descriptive statistics were used for data analysis.
RESULTS: Thirty patients were identified, with the mean age of 65 years, 60% were males and mean LOS was 4.6 days. Antithrombotic therapy included aspirin (63%) and clopidogrel (33%). Then mean bolus dose of bivalirudin was 0.75 mg/kg; mean infusion rate was 1.63 mg/kg/hr with a mean duration of 55 minutes. Guideline adherence in high-risk patients was evident in 83% of bivalirudin administrations. The transfusion rate was 6.6%. Transfused patients had renal insufficiency, improper dosing of the drug, and a mean LOS of 13 days.
CONCLUSIONS: The use of bivalirudin seems to decrease the transfusion rate in patients at high risk for bleeding undergoing PCI. Further investigation is warranted.

21. Fenoldopam for prevention of contrast-induced nephrotoxicity in cardiac patients undergoing catheterization. Kerry K. Pickworth, Pharm.D., *Crystal R. Tubbs, Pharm.D.,* Robert A. Barcelona, Pharm.D.; Ohio State University Medical Center, Columbus, OH.

PURPOSE: Fenoldopam, a selective dopamine$_1$ agonist, is currently FDA approved for treatment of severe hypertension. Unlike dopamine, fenoldopam may increase renal blood flow and thus potentially prevent contrast-induced nephrotoxicity by selectively stimulating dopamine receptors without α and β effects. The objective of this review was to evaluate use of fenoldopam in a tertiary care center in patients undergoing cardiac catheterization and describe outcomes related to renal function after drug administration.
METHODS: A retrospective chart review was completed on all patients receiving fenoldopam and discharged from cardiology services from July 2001-July 2002. Data collected included demographics, dosage, SCr, diuretic use, adverse effects, and fluid administration.
RESULTS: Forty-eight cardiology patients were identified by billing data who received fenoldopam before cardiac catheterization. Ten patients (20.8%) were excluded due to lack of SCr. Demographics: 47% males with mean age of 65, with 68.4% undergoing diagnostic catheterization. Identified comorbidities were diabetes (73.7%), congestive heart failure (34.2%), with 23.7% having both conditions. Mean maximum dose of fenoldopam was 0.2 µg/kg/minutes, with a mean fenoldopam infusion duration of 9 hours. 81% (31/38) of patients did not experience a SCr rise of ≥ 0.5 mg/dl and of those patients, 67.7% received saline hydration at
≥ 50 cc/hour concurrent with fenoldopam. Patients with both comorbidities had the largest increase in SCr (mean increase of 0.6 mg/dl). Hypotension was identified in 52.6% of patients receiving fenoldopam.
CONCLUSIONS: Prevention of contrast-induced nephrotoxicity in cardiology patients receiving catheterization may reflect concomitant fluid hydration and fenoldopam therapy rather than fenoldopam therapy alone.

22. Evaluation of ACE inhibitors for the prevention of cardiovascular complications and death after elective, noncardiac surgery. *Bradi L. Frei, Pharm.D.,* Christopher R. Frei, Pharm.D., Robert L. Talbert, Pharm.D., BCPS, FCCP; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: To evaluate perioperative angiotensin-converting enzyme (ACE) inhibitor use in patients at risk for cardiovascular complications after elective, noncardiac surgery.
METHODS: Medical records of 208 patients undergoing elective, noncardiac surgery admitted between 1 January 1999 and 30 June 1999 at a single academic institution were reviewed. Patients with coronary artery disease (CAD) or ≥ 2 cardiac risk factors were classified as "high risk" and considered eligible for perioperative ACE inhibitors. Cardiac risk factors included: age ≥ 65 years, hypertension, tobacco use, and total cholesterol ≥ 240 mg/dl. The

U.S. Social Security Death Index and the Texas Department of Health Death Index were used to determine all-cause mortality.
RESULTS: Forty-one (45%) of the 92 "high risk" patients received perioperative ACE inhibitors. Patients receiving ACE inhibitors had higher rates of hypertension (100% vs 82%, p=0.0039), diabetes mellitus (76% vs 51%, p=0.0144), and coronary artery disease (78% vs 67%, p=0.0473). All cause mortality (2% vs 22%, p=0.0102) was higher among patients not receiving an ACE inhibitor. Although not statistically significant, cardiac deaths were more common among patients not receiving an ACE inhibitor (0% vs 8%, p=0.1257). All patients expiring within 30 days of admission (N=4) were in the non-ACE inhibitor group.
CONCLUSIONS: All-cause mortality was lower among patients receiving ACE inhibitors despite higher rates of hypertension, diabetes mellitus, and coronary artery disease in this group. ACE inhibitors may exhibit a cardio-protective effect in patients at high risk, undergoing noncardiac surgery.

23. A phase IV trial evaluating the effectiveness and safety of dofetilide. *Michael A. Crouch, Pharm.D., BCPS,* Anna H. Vaden, Pharm.D.; Virginia Commonwealth University, Richmond, VA.

PURPOSE: To determine the effectiveness (rate of arrhythmia conversion) and safety (rate of QT prolongation and torsade de pointes) of dofetilide in clinical practice. Additionally, to determine whether the drug is being used according to established guidelines.
METHODS: In all patients, dofetilide dosing and associated QT interval prolongation were retrospectively evaluated. Patients were included in the effectiveness assessment if they: 1) received at least 36 hours of appropriate dofetilide dosing, 2) had persistent atrial fibrillation/flutter (AFF), and 3) did not receive direct current cardioversion during the evaluation period. Conversion was defined as obtaining and maintaining sinus rhythm within the first 36h of treatment. The conversion rate with dofetilide was compared to the EMERALD and SAFIRE-D trials using the Z test and high-risk subgroups were evaluated by chi-square analysis.
RESULTS: Investigators identified 107 patients. Trial demographic data were similar to previous studies, except patients were slightly younger (mean age 62.3 years), were more often female (41.1%), had a lower rate of structural heart disease (27.1%), and possessed better renal function (81.3% had estimated Cl Cr > 60 ml/minutes). Dosing followed established guidelines except 5.6% of prescribers were not confirmed, 63.4% of patients received the drug for a non-approved indication, 14% received a dose inconsistent with guidelines, and 12.1% received a contraindicated drug around dofetilide administration. No patients developed torsade de pointes; however, at some point during treatment 26.2% of patients developed QT prolongation (QT > 15% above baseline or > 500 ms). QT prolongation was more common in the elderly ($p<0.05$), women ($p<0.05$), and those with structural heart disease ($p<0.005$). In patients receiving appropriate dofetilide dosing for persistent AFF (n=25), the conversion rate to sinus rhythm was higher than previous studies (48% vs 27.2%; $p<0.05$).
CONCLUSIONS: In clinical practice, dofetilide was associated with a higher conversion rate than previous investigations, with a similar safety profile. Adherence with dosing guidelines remains an area for improvement.

24. Cardiac restitution does not predict the effects of lidocaine on arrhythmogenesis. *J. Jason Sims, Pharm.D.,* Jennifer M. Loeb, B.S., Nicholas A. Wiegert, B.S., Robert M. Twieg, Daniel L. Zatarski; University of Wisconsin, Madison, WI.

PURPOSE: The cardiac restitution hypothesis states that a steeply sloped restitution curve, relationship between the action potential duration (APD) on the previous diastolic interval (DI), creates unstable wave front propagation resulting in wave break and ventricular fibrillation (VF). Further, it is hypothesized that antiarrhythmic agents that reduce cardiac restitution curve slope prevent VF. However, drugs that only have single electrophysiologic effects have not been studied. Thus, we hypothesize that drugs that only alter conduction velocity (i.e. lidocaine) will decrease the cardiac restitution slope, but will not be antiarrhythmic.
METHODS: Cardiac restitution curves were constructed from intact swine hearts using a combination pacing and monophasic action potential probe placed at the left ventricular lateral wall endocardium. The heart was paced for 50 beats at cycle lengths ranging from 400ms to 180ms. Exponential fit restitution curves were constructed from the last beat APD_{90} (y-axis) versus the preceding DI (x-axis) during baseline and during placebo (n=8) or lidocaine 8 mg/kg/hour (n=6).
RESULTS: Lidocaine significantly decreased the slope of the restitution curve. The baseline average max slope was 1.01, however lidocaine decreased the average max slope to 0.45 ($p<0.05$). Importantly, the number of VF episodes during restitution testing at baseline was 0.13 ± 0.13 versus 2.4 ± 0.96 for lidocaine ($p<0.05$). There were no changes in any parameter during placebo.
CONCLUSIONS: It is hypothesized that decreasing cardiac restitution slope explains antiarrhythmic drug activity. However, the current study indicates that decreasing the slope of cardiac restitution is not predictive of the effects of lidocaine on arrhythmogenesis. This may be due to lidocaine only altering conduction velocity without significant changes in refractoriness. Thus, it appears more dynamic features are involved with antiarrhythmic drugs than simply decreasing cardiac restitution slope.

Critical Care

25. Alterations in the expression of key intestinal transporters and metabolic enzymes in thermally injured rats. *David R. Foster, Pharm.D.,* Christopher P. Landowski, M.S., Daniel S. Streetman, Pharm.D., Duxin Sun, Ph.D., Gordon L. Amidon, Ph.D., Lynda S. Welage, Pharm.D., FCCP; University of Michigan, Ann Arbor, MI; Purdue University, Indianapolis, IN.

PURPOSE: Intestinal transporters and metabolic enzymes are key determinants in oral drug/nutrient absorption, however burn-induced changes in intestinal transport/metabolism are unknown. This study describes changes in gene expression of key intestinal transporters/metabolic enzymes in thermally-injured rats.
METHODS: Rats were assigned to 30% TBSA, full thickness burn or control treatment (n=3/group). 24 hours after burn/control treatment, jejunal tissue was collected, RNA isolated, and transporter/enzyme expression determined using Affymetrix Genechips®. Alterations in expression of cytochrome P450 (CYP) enzymes (with > 60% human homology), p-glycoprotein (MDR1), and transporters for oligopeptides (PEPT1), amino acids (LAT1), organic cations (OCT1A), glucose (SGLT1), folate, and monocarboxyate (MCT1) were evaluated.
RESULTS: Over 3700 genes were expressed in rat jejunum. Thermal injury resulted in 2-5 and > 5-fold reductions in the expression of 493 and 80 genes, respectively, and 2-5 and > 5-fold increases in that of 344 and 23 genes, respectively. Changes in transporter/enzyme expression are shown below.

Gene	Expression (florescence intensity, mean ± SD)		
	Control	Burn	p value
MDR1	25.0 ± 8.0	undetectable	na
PEPT1	341.2 ± 35.7	499.1 ± 59.3	0.02
Folate	227.2 ± 24.5	488.3 ± 122.0	0.02
SGLT1	1374.2 ± 134.0	1671.7 ± 228.4	0.12
LAT1	55.2 ± 4.0	41.2 ± 16.4	0.22
MCT1	41.8 ± 24.1	10.2 ± 11.2	0.11
OCT1A	85.5 ± 24.9	133.6 ± 51.3	0.22
CYP2D5	111.8 ± 29.3	186.7 ± 26.0	0.03
CYP3A9	2262.1 ± 58.9	5628.0 ± 1099.9	0.006
CYP2D4	51.9 ± 20.1	168.3 ± 31.0	0.005
CYP2B12	2014.5 ± 116.4	10424.9 ± 3907.8	0.02

CONCLUSIONS: Thermal injury profoundly alters intestinal gene expression. The expression of certain influx transporters (e.g., PEPT1, folate) and CYP's 2D5, 3A9, 2D4, and 2B12, was significantly increased, whereas that of the efflux transporter MDR1 was reduced. These changes may contribute to altered oral drug/nutrient absorption in thermally-injured patients.

26E. Peptide permeability is preserved in cytokine-treated caco-2 cells. *David R. Foster, Pharm.D.,* Jeffrey P. Gonzales, Pharm.D., Christopher P. Landowski, M.S., Lynda S. Welage, Pharm.D., FCCP; University of Michigan, Ann Arbor, MI.

Presented at the 32nd Critical Care Congress of the Society of Critical Care Medicine, San Antonio, TX, January 30, 2003-February 1, 2003.

27. IFG-1 concentrations in cerebrospinal fluid following traumatic brain injury. *M. Bonnie Rosbolt, Pharm.D.,* Brant Sachleben, B.S., A. Byron Young, M.D., Jimmi Hatton, Pharm.D., FCCP; University of Kentucky Chandler Medical Center, Lexington, KY.

PURPOSE: Neuroprotective properties of IGF-1 continue to be investigated. IGF-1 serum concentrations are depressed in adults and pediatric patients following TBI. This study was designed to measure IGF-1 concentrations in cerebrospinal fluid (CSF) following traumatic brain injury (TBI) in adult and pediatric patients.
METHODS: Adult (A) and Pediatric (P) patients with severe TBI, Glasgow Coma Scale (GCS) 4-8, were included. CSF was collected from intraventricular catheters during the first 96 hours following injury and IGF-1 was quantified using radioimmunoassay (ALPCO Diagnostics). Data analysis included a two-sample t-test and Anova.
RESULTS: Nine adults (5 Males, 4 Females) and 13 pediatric (10 Males, 3 Females) were included. The ages were 27 ± 8.4 and 12 ± 3.9 years with GCS of 6.2 ± 1.3 and 6.5 ± 0.89, respectively. Mean IGF-1 CSF within 24, 48, and 96 hours post injury for adults was 0.735 ng/ml ± 0.035, 0.709 ± 0.042 and 0.706 ng/ml ± 0.033 ng/ml and for children were 0.889 ± 1.47, 0.469 ± 0.715 and 0.187 ± 0.128 ng/ml. There was no statistical difference between the groups or compared to values from non-TBI patients.
CONCLUSIONS: This is the first report of IGF-1 concentrations in CSF following TBI. The effect of TBI on IGF-1 disposition should be further characterized to determine the potential for exogenous IGF-1 administration in providing neuroprotection.

28. Effects of extracorporeal membrane oxygenation circuit on lorazepam. *V. Bhatt-Mehta,* G. M. Annich, J. R. Custer; University of Michigan, Ann Arbor, MI.

PURPOSE: To evaluate the effects of the polyvinylchloride (PVC) tubing and the membrane oxygenator (MO) on the concentrations of L in the ECMO circuit.
METHODS: An in-vitro model that included a closed Extracorporeal Membrane Oxygenation (ECMO) circuit with a MO, heat-exchanger, bladder and PVC tubing was used. The circuit was primed with blood, electrolytes, albumin and heparin and maintained at physiologic pH and temperature throughout. Lorazepam (L) was studied in 3 separate but identical circuits for 6 hours on day of circuit prime and then again at 24 hours (new and old circuit). Each circuit (new and old) was spiked once with L to a final concentration of 250 ng/ml. Serial samples were drawn at baseline and every 30 minutes for 6 hours at the site of injection (Port A), pre- (Port B) and post-MO (Port C) for each circuit. L was analyzed using gas chromatography with electron capture. The differences in concentrations at sample sites was expressed as % of original concentration.
RESULTS: In the new circuits, the difference in concentration between A and B (extraction by PVC tubing) at 2 hours (maximum difference) following injection represented nearly 5% of the original concentration. The concentrations remained steady for the rest of the study period. A nearly 12 % decline in original concentration between ports A and B occurred at 24 hours (old circuit). Similar data analysis for ports B and C (representing extraction by MO) produced nearly 15% fall in concentrations across MO at 1 hr in the new as well as the old circuits. After this, the concentrations remained fairly steady for rest of experiment.
CONCLUSIONS: This single-dose study shows that 20-27% of a dose of L may be extracted by PVC and MO during bypass depending on the age of the circuit. As the circuits become older this amount could increase. These data may explain in part the higher doses of L seen in ECMO patients requiring sedation.

29. Fenoldopam as a renoprotective agent in patients undergoing cardiopulmonary bypass. *Amy L. McFerrin, Pharm.D.,* Marc G. Reichert, Pharm.D., BCPS, John W. Hammon, M.D.; Wake Forest University, Winston-Salem, NC.

PURPOSE: This study was designed to compare the incidence of post-operative renal failure between patients with preoperative renal insufficiency undergoing cardiopulmonary bypass (CPB) who received fenoldopam with those who did not receive fenoldopam.
METHODS: Medical records of 110 patients undergoing CPB between August 1998 and August 2001 were reviewed. All patients had a history of chronic renal insufficiency, a preoperative serum creatinine of 1.5 mg/dl or greater, and were at least 18 years of age. Data collected included preoperative and postoperative medications, past medical history, severity score, and procedure characteristics. Discharge serum creatinine, use of dialysis, length of stay, and mortality were also documented. The primary outcome assessed was the development of renal failure, defined as a $\geq$ 0.5 mg/dl increase in serum creatinine from baseline to discharge, or need for dialysis.
RESULTS: There was no statistically significant difference between study groups in the incidence of renal failure, dialysis requirement, or mortality. The incidence of renal failure in the control group was 4% versus 11% in the fenoldopam group; dialysis requirement was 4% versus 2%, and mortality was 8% versus 11% in the control and fenoldopam groups respectively. Additionally, the length of ICU stay and total hospital stay were not different between the two groups.
CONCLUSIONS: These results do not support the renoprotective effects of fenoldopam in patients undergoing cardiopulmonary bypass.

30E. Amiodarone is not advantageous for non-cardiac post surgical atrial arrhythmias. *Anthony T. Gerlach, Pharm.D.,* Paul Beery, M.D., Charles Cook, M.D., Sandra Kane, Pharm.D., Vihas Patel, M.D., David Robertson, M.D., Joseph Dasta, M.S., David Jones, M.D., Larry Martin, M.D.; Ohio State University Medical Center, Columbus, OH.

Presented at the 32nd Critical Care Congress of the Society of Critical Care Medicine, San Antonio, TX, February 1, 2003.

31. Effect of multiple episodes of inadequate empiric antibiotic therapy for ventilator-associated pneumonia on morbidity and mortality in critically ill trauma patients. *Eric W. Mueller, Pharm.D.,* Scott D. Hanes, Pharm.D., G. Christopher Wood, Pharm.D., Martin A. Croce, M.D., Timothy C. Fabian, M.D., Bradley A. Boucher, Pharm.D., FCCP; University of Tennessee Health Science Center, Memphis, TN.

PURPOSE: Single episodes of inadequate empiric antibiotic therapy (IEAT) for ventilator-associated pneumonia (VAP) increase morbidity and mortality. However, the cumulative effects of multiple episodes of IEAT are unknown. We studied the effect of single and multiple episodes of IEAT for VAP on morbidity and mortality in critically ill trauma patients.
METHODS: Retrospective review of critically ill patients with multiple episodes of VAP at a level-1 trauma center admitted within a 2-year period. IEAT was defined as empiric antibiotic therapy without in vitro activity against the causative bacteria. The effect of IEAT on ICU length of stay, mechanical ventilation days, and mortality was determined using chi-square, Cox regression analysis, and multivariate logistic regression as appropriate.
RESULTS: Eighty-two patients with 200 episodes of VAP were included. There were 78 (39%) episodes of IEAT. Crude mortality rates were 3.6%, 8.8%, and 45% ($p<0.001$) in patients experiencing 0 (n=28), 1 (n=34), or >1 (n=20) episode of IEAT, respectively. Demographics, severity of illness, and injury severity were similar between groups. The risk of death (OR 10.5; 95% CI 1.3-83.1) increased with increasing number of IEAT episodes after adjusting for age, severity of illness, organ dysfunction, and total number of VAP episodes. Multiple episodes of IEAT were also associated with prolonged ICU stay ($p=0.007$), and prolonged mechanical ventilation ($p=0.005$).
CONCLUSIONS: Critically ill trauma patients with VAP experiencing multiple episodes of IEAT for VAP have increased morbidity and mortality compared to patients with zero or one episode of IEAT. Aggressive empiric antibiotic therapy against a broad spectrum of bacteria should be considered in patients with a previous episode of IEAT.

Drug Delivery

32. Accuracy of splitting un-scored valdecoxib tablets versus scored controls. *Anthony P. Morreale, Pharm.D., MBA, BCPS,* Brian K. Plowman, Pharm.D., MBA, BCPS, Melissa Delattre, Pharm.D., Monica Schaefer, Pharm.D., Daniel Boggie, Pharm.D.; Veterans Affairs San Diego Healthcare System, San Diego, CA.

PURPOSE: Controversy exists regarding the widespread practice of cutting medications to save cost. Unfortunately, there are few well designed studies that examine the issues including the splitability of the products. Several studies have examined the weights of half tablets but none to our knowledge have included a control group consisting of a FDA approved scored drug of approximately the same size and shape as the drug in question.
METHODS: One hundred and twenty un-scored valdecoxib 20 mg tablets where split. As a control we split 30 scored Metoprolol 10mg tablets. Whole tablets were weighed prior to and halves after splitting.
RESULTS: Mean variability of halved 20mg valdecoxib tablets was between -1.75% and +1.15%, while variability of the control was between -1.75% and + 1.50%. Statistical difference in variability between groups was not demonstrated. However, 46 of 240 (19%) valdecoxib halves exceeded the 10% USP variance standards versus 1 of 60 (1.6%) of the control group.
CONCLUSIONS: Cutting valdecoxib led to variability in half-tablet weights that, on average, did not exceed the expected weights by more than 10% and was similar to the variability found with scored tablets. However, individual halves did exceed the standards. Because of valdecoxib's long half-life and wide therapeutic margin one would not expect differences in clinical outcomes of a 10mg valdecoxib tablet versus half of a 20mg valdecoxib tablet. However, caution should be exercised when splitting agents with short half-lives or narrow therapeutic indexes where small variability may impact clinical outcomes.

Education

33. Assessment of community pharmacists knowledge, skill, comfort and interest in performing cancer awareness and prevention activities. *William J. Spruill, Pharm.D.,* William E. Wade, Pharm.D.; University of Georgia, Athens, GA.

PURPOSE: To survey Georgia Pharmacists concerning both their knowledge and attitudes about performing pharmacy-based cancer awareness and prevention (CAP) education, and interest in a web-based ACPE-approved certification course that teaches knowledge and skills needed to develop a CAP intervention program.
METHODS: A sixteen-item 3 section survey instrument was mailed to all licensed pharmacists in Georgia. Section one contained respondent's demographic information, section two contained information characterizing existing CAP practices, while section three surveyed pharmacist's ability and interest in participating in a web-based CAP certification program.
RESULTS: To date, 489 surveys have been returned to the investigators. Results show that less than 25% are routinely providing some cancer-related educational materials and 80% of respondents have not participated in any CAP training in the last five year s. Approximately two-thirds of respondents indicated that they have patients inquire about cancer warning signs and symptoms of cancer or early detection/screening tests/procedures on at least a monthly basis. The majority of respondents rated their interest level in providing CAP information to patients in their practice settings as "interested or very interested", while less than half rated their 'comfort level' and 'knowledge level' as either "comfortable/knowledgeable" or "very comfortable/very knowledgeable." Lastly, most pharmacists indicated a desire to participate in a web-based training program to enhance their skills in CAP.
CONCLUSIONS: Pharmacists can provide an important public health role in performing CAP interventions targeted to their 'at-risk' patients. They would

like to receive more formalized training to help enhance their skills in this area.

34. Prospectively educating PA students about pharmaceutical marketing techniques. *Shannon L. B. Miller, Pharm.D.*, Gary Milavetz, Pharm.D., Theresa E. Hegmann, MPAS, Richard W. Dehn, MPA, Jay D. Currie, Pharm.D.; University of Iowa, Iowa City, IA.

We devised an interdisciplinary educational program intended to instruct Physician Assistant students (PAS) regarding pharmaceutical marketing techniques and sensitizing them to ethical issues.
PURPOSE: The goal of this study is to characterize PAS interactions with, and attitudes toward, pharmaceutical sales representatives' (PSRs) activities.
METHODS: Second year PAS were surveyed twice during their clinical clerkships, 6 months apart. The sequence of events was: (1) complete survey; (2) College of Pharmacy faculty lectured on pharmaceutical marketing strategies; (3) lunch was sponsored by a pharmaceutical company, including a 30 minute "educational" presentation including product displays; and (4) follow-up discussion about marketing strategies and ethical issues. Fischer's Exact test and the Wilcoxon Rank Sum were used to analyze the data.
RESULTS: By the second survey, all 23 PAS had contact with PSRs, and had accepted something of monetary value ($p<0.05$). PSR contacts increased from a median of 6 (0-75) to 20 (4-100). PAS judged the information presented to them by PSRs to be less helpful ($p<0.03$) and more biased ($p<0.01$) by the second survey. PA students increasingly agreed that pharmaceutical marketing had an impact on the prescribing habits of other practitioners ($p<0.02$), but disagreed that receiving gifts or meals from PSRs influenced their own selection of products.
CONCLUSIONS: These findings suggest that exposure to a brief interdisciplinary educational intervention can assist PA students to critically analyze pharmaceutical marketing information, and may influence their attitudes about the reliability, usefulness and ethical implications of interactions with PSR's.

35. The impact of physician or health care provider counseling on smoking cessation: a population-based study using a national public health data base. M. Nawal Lutfiyya, Ph.D., *Linda Chang, Pharm.D.*, My Linn Sawyer, M.D.; University of Illinois; OSF St. Anthony Medical Center, Rockford, IL.

PURPOSE: Smoking cessation programs are costly with corresponding modest outcomes or success rates. In fact, numerous research studies show that within a year of participation in an intensive smoking cessation program, only 20 percent of the participants remain non-smokers. In other words, the relapse rate is high. This study attempts to examine the impact of brief counseling regarding smoking cessation, by health care providers, on smoker's quitting habits. Studying this phenomenon is important since, if such a non-labor intensive intervention is effective, more smokers could be more easily reached and impacted at a substantially reduced cost. Also examined in this study are other factors (demographic, socioeconomic, and education) which differentiate smokers from non-smokers and as well as long-term abstainers from short-term ones.
METHODS: Available public health data (from the Behavioral Risk Factor Surveillance Survey 1995-2000) on smoking habits (current smokers, short and long-term quitters), health care provider counseling, and other factors (demographic, socioeconomic, and education) are analyzed using multiple methods. The Behavioral Risk Factor Surveillance Survey is a state-based sample survey that all states participate in. The survey is CDC-funded and administered. Data are collected through a random-digit dial phone survey on all non-institutionalized adults 18 years and older. In this study, logistic regression is used to test an explanatory model.
RESULTS: Annually, approximately 180,000 respondents are surveyed on their health risk behavior. Of those surveyed in 2000, 45,202 respondents were former smokers and approximately 31,000 had abstained from smoking for six or more years. None of those respondents were counseled about their smoking habits by a physician or health care provider. Exercise and education were factors identified as significantly impacting smokers to become non-smokers.
CONCLUSIONS: Surprisingly, physicians or health care providers had little or no impact on the decisions of smokers to quit. Both the lack of counseling as well as the effecting factors are discussed in detail.

36. End-of-life care education in United States pharmacy schools. *Christopher M. Herndon, Pharm.D., BCPS*, Kenneth C. Jackson, II, Pharm.D., David Fike, M.S., Tresa Woods, M.S.W.; Ortho-McNeil Pharmaceutical, O'Fallon, IL; Texas Tech University Health Science Center, Lubbock, TX; Texas Tech University Health Science Center, Amarillo, TX.

PURPOSE: Hospice and palliative care have undergone dramatic changes in the past thirty years. Educational initiatives and certification programs for physicians (American Board of Hospice and Palliative Medicine) and nurses (National Board for Certification of Hospice and Palliative Nurses) have further delineated this area of practice as a focused area of practice, apart from that of geriatrics, neurology, anesthesiology or oncology. As other professions assess their own practices of hospice/end-of-life (EOL) care education in their respective schools and colleges, the profession of pharmacy must too assure that its future graduates are adequately prepared to participate in this type of care.
METHODS: This was a descriptive study in which all accredited schools/colleges of pharmacy in the United States were queried regarding their level of curricular commitment to EOL care. Eighty-three questionnaires were mailed with 60 schools responding (72% response rate). Four primary informational items regarding EOL/palliative care education were targeted, including availability of didactic teaching, specialization of pharmacy faculty, availability and type of clerkships, and method/type of instruction.
RESULTS: Sixty-two percent of respondents indicated EOL care education was provided didactically (3.89 ± 1.91 lecture hours per year). Fifty-eight percent of respondents indicated that EOL care experiential clerkships were available (4.97 ± 1.25 weeks in duration).
CONCLUSIONS: This data indicates that over half of U.S. pharmacy students receive some exposure to EOL care education. More in-depth evaluation of curricular commitment to EOL care education in United States pharmacy schools/colleges should be performed.

37. Adverse drug reaction reporting and medication safety in the pharmacy curriculum. *Catherine M. Crill, Pharm.D.*, Susannah E. Motl, Pharm.D., Naseem Amarshi, M.S., Pharm.D.; University of Tennessee Health Science Center, Memphis, TN.

PURPOSE: To assess students' knowledge of adverse drug reactions (ADRs), perceptions, confidence, and experience with reporting ADRs, and to increase student awareness of medication safety.
METHODS: Effective with the 2002 academic year, an ADR reporting requirement has been incorporated into the applied therapeutics course in the third professional year. A baseline survey of students was conducted (n=96) prior to this requirement. Questions assessed perceptions of ADR reporting, confidence and skills in detecting and reporting ADRs, and prior experience with reporting ADRs. To track the learning process, students will be surveyed again at the end of the academic year.
RESULTS: Ninety-four students (97.9%) responded to the survey. The majority of students (61/94) rated their ADR detection skills as "needs improvement," while 14% (13/94) rated their skills as "good" and 21% (20/94) as "unsatisfactory." Almost half (46/94) felt their ability to report an ADR was unsatisfactory. Five percent (5/94), 16% (15/94), and 19% (18/94) reported their ability to report an ADR as "excellent," "confident," or "somewhat confident," respectively. Ten students were unable to rate their ability. Although 100% of students felt ADR reporting is a pharmacist's responsibility, 83% (78/94) had never reported an ADR. Fourteen students had reported ≤ 5 ADRs, and 2 had reported > 5 ADRs. Since beginning this requirement, 20 students have identified and reported an ADR in the applied therapeutics course.
CONCLUSIONS: Although the students perceive ADR reporting to be a pharmacist's responsibility, their comfort level at identifying and reporting ADRs needs improvement. The incorporation of this course requirement has increased student ADR reporting.

38. Comparison of evidence-based medicine knowledge between physician faculty, physician residents, and pharmaceutical industry representatives. *Mark C. Granberry, Pharm.D.*, Jill T. Johnson, Pharm.D., Sherry Myatt, Pharm.D., Renee McAfferty, Pharm.D., Jonell Sabbe, Pharm.D., Scott Warmack, Pharm.D., Eugene S. Smith, M.D.; Texas Pan American University of Texas at Austin, Edinburg, TX; University of Arkansas for Medical Sciences, Little Rock, AR; University of Arkansas for Medical Sciences, Pine Bluff, AR; University of Arkansas for Medical Sciences, El Dorado, AR; Northwest Family Medical Center, Springdale, AR.

PURPOSE: Optimal patient care incorporates the interpretation of the results obtained from well-designed clinical trials together with clinical judgment, an approach referred to as evidence-based medicine (EBM). Many sources of drug therapy information exist, one of which is pharmaceutical industry representatives. One potential obstacle to the use of EBM is the clinician's ability to critically evaluate the study design and statistical methods used when discussing drug therapy studies with pharmaceutical industry representatives.
METHODS: An eight-question survey to determine an individual's understanding of clinical study design and statistical concepts was validated and administered to pharmaceutical industry representatives, family practice physician faculty and family practice residents. ANOVA was used to compare the percent of correct responses among the three groups. Statistical significance was set at $p<0.05$. Data are expressed as the average percent of correct responses " standard deviation.
RESULTS: Seventy-four subjects completed the survey, of these 48 were residents, 15 were industry representatives, and 11 were faculty. The percent of correct responses for all subjects was 34.2 ± 20. The mean percent of correct responses by residents was 31.7 ± 18.9, by industry representatives was 35 ± 17.2, and by faculty was 44.3 ± 26.4. ($p=0.17$).
CONCLUSIONS: The overall percent of correct responses for our survey of statistical concepts and study design was poor. There were no statistically significant differences between residents, faculty or industry representatives. We conclude that measures to increase physician's and pharmaceutical

industry representative's understanding of statistical methods and study design are warranted.

Endocrinology

39. Clinical and laboratory evaluation of menopausal status, dyslipidemia, and thyroid function in Jordanian women: a cross-sectional study. *Sireen A.R. Shilbayeh, Ph.D.*; Al-Zytuna University, Amman, Jordan.

BACKGROUND: Several epidemiological studies indicated increased incidence of coronary heart disease (CHD) in postmenopausal women compared to men of similar age, which is basically related to estrogen deprivation. In addition, hypothyroidism, being a common disorder in elderly women more than old men, is declared to induce atherosclerosis with an extent comparable to that for known classic risk factors of CHD. However, considerable controversy surrounds this association and its mediated physiological mechanisms.
PURPOSE: To examine the complex triple inter-relationship between dyslipidemia, menopause, and thyroid abnormalities in a group of Jordanian women during climacteric period.
METHODS: A cross-sectional study of premenopausal, perimenopausal, and postmenopausal women who were visiting various clinics in Al-Bashir hospital, Jordanian University Hospital, Ibn-Alhytham hospital and other gynecology private clinics over a period of two years (between August 2000-August 2002). Lipid profile, fasting blood sugar (FBS), thyroid stimulating hormone (TSH), free thyroxine (FT4), and follicle-stimulating hormone (FSH) were determined in the obtained blood samples. Other demographic, social, lifestyle, and clinical data were evaluated during a 4-hour interview/examination in a senior health clinic.
RESULTS: A total of 149 women were actually included in analyses. The total prevalence of dyslipidemia was 60% of which 20% were not previously diagnosed, and with similar rates in peri and postmenopause. When further multiple comparisons were performed, postmenopausal women were revealed to have significantly higher FBS than pre and perimenopausal subjects (p=0.05), while their total cholesterol and LDL were only significantly elevated from premenopausal females (p=0.01, p=0.03 respectively). The latter finding was considerably substantial for postmenopausal women who had never been exposed to HRT (p=0.01). Although, the triglyceride (TG) levels were higher in postmenopause as contrasted to pre and perimenopause categories, the final results did not reach the level of statistical significance (p=0.7). The total prevalence of thyropathy based on TSH and free thyroxine levels in addition to past medical history was 29.5% of the study sample. However, no marked association was found between thyropathy and neither menopausal status (OR=1.75, 95% CI, 0.6 to 5; p=0.3), nor dyslipidemia (OR=0.7; 95% CI, 0.3 to 2; p=0.56). Adding additional terms to the previous multiple logistic regression model such as classic CHD risk factors [hypertension, abnormal fasting blood sugar, smoking status, age categories (≥55 as compared to <55 years of age), physical activity (low as compared to high physical activity)], and previous HRT use, did not undermine the significance of odds ratio relating postmenopause to hyperlipidemia (OR=5; 95% CI, 1.1 to 18.3; p=0.03). While, the association between dyslipidemia and perimenopause lost its statistical significance on the same multivariate regression model (OR=2.8; 95% CI, 0.7 to 10, p=0.11). Interestingly, the current or ever use of HRT did not reduce the odds ratio for abnormal lipid estimation in the peri and postmenopausal women compared to pre, peri, and postmenopausal subjects who had never used HRT (OR=2.15; 95% CI, 0.81 to 5.7, p=0.13).
CONCLUSIONS: In general the high prevalence of thyroid disease in our women population was independent on age or menopausal condition, and although dyslipidemia was strongly associated with postmenopause, it occurred at equal probabilities in both euthyroid as well as thyropathic postmenopausal women. Therefore, future studies should focus on determination of other potential non-lipid-thyropathy-mediated mechanisms contributing to increased cardiac mortality in elderly women. In addition, physicians in preventive medical practices should rethink their views of HRT risks and benefits in the light of most recent clinical trials. Yet, on molecular basis, scientists suspicions with regard to novel mechanisms by which estrogen improves climacteric manifestations should stimulate new directions in future research.

Gastroenterology

40E. The impact of age on the severity of erosive esophagitis in patients with gastroesophageal reflux disease. David A. Johnson, M.D., *Albert Roach, Pharm.D.*, Mark B. Sostek, M.D.; Eastern Virginia Medical School, Norfolk, VA; AstraZeneca LP, Wayne, PA.

Presented at the 107th Annual American Osteopathic Association Convention and Scientific Seminar 2002.

Geriatrics

41. Characteristics of acetylcholinesterase inhibitor use in a university geriatric outpatient population with dementia. *Sunny A. Linnebur, Pharm.D.*, J. Mark Ruscin, Pharm.D.; University of Colorado Health Sciences Center, Denver, CO.

PURPOSE: This study evaluated the use of acetylcholinesterase inhibitors (AIs) in a university geriatric population with dementia to assess: 1) demographic characteristics of patients receiving AI treatment, 2) specific AI utilized, 3) dose and treatment duration, and 4) concomitant medications.
METHODS: A medical record review of 354 geriatric outpatients ICD-9 coded for Alzheimer's disease or dementia identified 125 patients with dementia and documented AI treatment between 9/96 and 7/02. Demographic, Mini-Mental State Examination (MMSE) scores, and medication use data were collected.
RESULTS: Patients prescribed AIs were primarily female (70%) and Caucasian (94%). Only 12% of non-Caucasian patients were treated with AIs, compared with 43% of Caucasians (p<0.01). No difference was noted in treatment based on sex. Average age and MMSE score at diagnosis were 79.6 years and 21.2, respectively. AIs were initiated an average of 10.8 months after diagnosis (95% donepezil) and were continued for an average of 18.6 months (donepezil), 8.9 months (rivastigmine), and 5.8 months (galantamine). Average daily doses for donepezil, rivastigmine, and galantamine were 8.2 mg, 6.7 mg, and 17.6 mg, respectively. One-third of patients discontinued treatment, mainly due to side effects (47%) or perceived ineffectiveness (32%). Concomitant medications included: anticholinergics (15%), vitamin E (50%), ginkgo (14%), ASA/NSAIDs (44%), estrogen (15%), and statins (9%).
CONCLUSIONS: Caucasians comprised the majority of AI treated patients, indicating a race disparity within this population. The majority of patients was prescribed donepezil and continued it for over one year, suggesting long-term tolerability and perceived benefit. Additionally, many patients utilized alternative medications for dementia.

42. Patients with Alzheimer's dementia still receiving anticholinergics. *Jeanette L. Altavela, Pharm.D.*; Greater Rochester Independent Practice Association, Rochester, NY.

PURPOSE: To determine how commonly physicians prescribe centrally acting moderate to strong anticholinergic medications for patients currently on acetylcholinesterase inhibitors.
METHODS: Identification of all patients with prescription coverage in a capitated population that filled a prescription for one of the following acetylcholinesterase inhibitors (donepezil, galantamine, rivastigmine, tacrine) in a 12 month period (March 2001 through February 2002). A complete prescription refill record was obtained for patients having at least one prescription for an acetylcholinesterase inhibitor. A clinical pharmacist manually assessed refill records to determine if the patient was prescribed a centrally acting medication with moderate to high anticholinergic properties during the same time period as the acetylcholinesterase inhibitor.
RESULTS: The 102 patients identified as filling prescriptions for an acetylcholinesterase inhibitor were 71-94 years old. Fifteen patients (14.7%) were prescribed centrally acting moderate to strong anticholinergic medications at the same time. Almost half of these medications prescribed had strong anticholinergic activity.
CONCLUSIONS: There continues to be use of centrally acting moderate to strong anticholinergic medication's in elderly and more specifically in patients with Alzheimer's dementia. This presents an opportunity to educate physicians about the potential harm of using moderate to strong anticholinergics medications in this population and teach them about medications and treatments that can be used for the same indications, with minimal or no anticholinergic effects.

43. Utilization of acetylcholinesterase inhibitors in Alzheimer's patients in a long-term care setting. *Michael Fazio, Pharm.D.*, Kevin J. Lynch, Pharm.D., BCPS; Omnicare Pharmacy Services of Pennsylvania, Greensburg, PA; Pfizer, Inc., Pittsburgh, PA.

PURPOSE: It has been demonstrated that patients initiated on acetylcholinesterase inhibitors (AchEI) early in the course of the disease are able to maintain a better functional status and persistent treatment throughout the course of illness have cognitive, behavioral, and economic benefits. This retrospective study was designed to evaluate utilization rates of AchEI across 12 long-term care facilities throughout the state of Pennsylvania.
METHODS: Long term care resident's computerized pharmacy records, comprising a single moment in time in 2001, were analyzed.
RESULTS: All residents', from 12 facilities (n=2070), records were reviewed with 982 (48%) patients having a diagnosis of Alzheimer's disease or dementia. The mean and median age was 85 years (58-102). The majority of residents with a diagnosis of Alzheimer's disease or dementia (73%, n=718) were not prescribed an AchEI (donepezil, galantamine, rivastigmine, tacrine).

Of the 264 residents prescribed AchEI, the stratification of each agent is as follows: 73% (n=192) for donepezil, 16% (n=43) for rivastigmine, and 11% (n= 29) for galantamine. Mean dosages for the AchEI were: donepezil (8.6 mg), rivastigmine (9.8 mg), and galantamine (7.2 mg).
CONCLUSIONS: There is an increasing number of clinical and pharmacoeconomic studies in the literature available that support the early and persistent prescribing of acetylcholinesterase inhibitors for the treatment of Alzheimer's disease. Despite this information, we found that in this long term care population most residents with a diagnosis of Alzheimer's disease or dementia were not prescribed or maintained on these agents.

44. Treatment of behavioral symptoms in Alzheimer's patients in a long-term care setting. *Michael Fazio, Pharm.D.*, Kevin J. Lynch, Pharm.D., BCPS; Omnicare Pharmacy Services of Pennsylvania, Greensburg, PA; Pfizer, Inc., Pittsburgh, PA.

PURPOSE: Behavioral disturbances complicate Alzheimer's Disease (AD) in approximately 60% of patients with dementia, and include psychosis, agitation, and depression. Behavioral disturbance management is important because behavioral symptoms are distressing to the patient and caregiver. Recent findings suggest that acetylcholinesterase inhibitors (AchEI) can improve behavioral aspects of AD. This retrospective study was designed to compare the use of psychoactive medications in dementia patients treated with AchEI versus those untreated in 12 long-term care (LTC) facilities throughout the state of Pennsylvania.
METHODS: Pharmacy records of 2070 LTC resident's comprising a single moment in time in 2001 were analyzed. Residents' diagnosis and treatment regimens were reviewed.
RESULTS: AD or dementia was diagnosed in 982 (48%) residents. Mean and median age was 85 years (58-102). Fifty-three percent of AD residents were prescribed behavioral medications (antidepressants, antipsychotics, or sedatives). Of AchEI patients, 68% were prescribed behavioral medications; 60% of patients not on AchEI were on behavioral medications. The most common classes of behavioral medications prescribed in AchEI patients versus not on AchEI were antidepressants 48% and 34% ($p<0.001$); antipsychotics 34.2% and 28.2%; and sedatives 15.2% and 12%, respectively.
CONCLUSIONS: Behavioral disturbances are a common complication of AD and most residents were prescribed agents to treat behavioral changes. Residents prescribed AchEI demonstrated a greater utilization rate of agents to manage behavioral symptoms. These findings may be related to the under-utilization of AchEI agents in early stages of AD in LTC and the influence of psychiatry input in the more difficult behavior disorder cases.

Health Services Research/Managed Care

45E. An assessment of the affiliation between authors and sponsors of published clinical trials over a 20-year period: an unhealthy alliance? Susan Buchkowsky, B.Sc., *Peter J. Jewesson, Ph.D., FCSHP*; Vancouver Hospital and Health Sciences Center, Vancouver, BC, Canada.

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46. Comparison of health care service use and costs among patients with osteoarthritis initiating therapy on long-acting opioids. Raafat Seifeldin, Pharm.D., Ph.D., *Patricia R. Grossman, Pharm.D.*; Purdue Pharma LP, Stamford, CT.

OBJECTIVE: Comparison of pharmacy and health care services costs among osteoarthritis patients initiating therapy with a long-acting opioid (LAO): controlled-release oxycodone (CRO), transdermal fentanyl (TDF), or controlled-release morphine sulfate (CRMS).
METHODSOsteoarthritis patients newly prescribed CRO, TDF or CRMS were identified using the MEDSTAT MarketScan® database (1997-2000). Ordinary least square regression models calculated adjusted total and pharmacy costs. Pharmacy costs were divided into LAO, short-acting opioids (SAO), and non-steroidal anti-inflammatory drugs (NSAIDs) costs. An intent-to-treat analysis compared health care resource utilization and costs over the 6 months following therapy initiation. Models controlled for co-morbid pain conditions, previous health care utilization and cost, non pain-related co-morbidities, patient demographic characteristics, and type of health plan. Per-member costs are reported.
RESULTS: Totals of 2,343 CRO; 430 TDF and 296 CRMS initiators were identified. Adjusted total and pharmacy costs six months following were significantly lower for CRO initiators (total - $4,616, pharmacy - $1,474; $p<0.01$) compared with TDF (total - $5,881, pharmacy - $2,094) and CRMS (total - $6,207, pharmacy - $2,062) initiators. LAO and SAO costs were: CRO- LAO $282 (p=NS TDF, $p<0.05$ CRMS) and SAO $243 (p=NS TDF, p=NS CRMS); TDF- LAO $302 (p=NS CRMS) SAO $216 (p=NS CRMS); CRMS- LAO $334 and SAO $244. Concomitant NSAID costs were: $132 ($p<0.05$ TDF; p=NS CRMS) for CRO; $159 (p=NS CRMS) for TDF and $129 for CRMS initiators.
CONCLUSIONS: Total and pharmacy costs in CRO osteoarthritis initiators were significantly less over a 6-month period compared to TDF and CRMS initiators suggesting pharmacy costs impact total costs.

47. Pharmaceutical samples and effects on prescribing behavior in family medicine residency training clinics. *Sara L. Noble, Pharm.D.*, William H. Replogle, Ph.D., Diane Beebe, M.D., Steve A. Watts, M.D., Christy Nohra, Brandon Skelton, Jaime Shaw; Pfizer, Inc.; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: To evaluate the relationship between sample room inventory and prescribing behavior of resident/ faculty providers in two family medicine residency training clinics.
METHODS: All anti-hypertensive medications were removed from sample closets and restocked with two of four anti-hypertensive classes: β-blockers, calcium channel blockers, angiotensin converting enzyme inhibitors, and angiotensin receptor blockers. With the exception of β-blockers, each class was represented by 4 to 8 different brand name samples. No other classes or combination anti-hypertensive agents were stocked. To control for subject bias, clinic personnel were informed that the prevalence and treatment of osteoarthritis and related diseases was being studied; patient records, billing data, and the sample closet would be involved. In addition, COX-2 and statin samples were also manipulated as a further distraction.
RESULTS: Data from 532 patient visits for which there was a diagnosis of hypertension were reviewed. There were 54 new prescriptions and 41 discontinuances in the four classes of anti-hypertensive medications. Chi-square and multiple logistic regression analysis were used to test for a relationship between presence or absence of anti-hypertensive agents in the sample closet and providers prescribing behavior. For each analysis, we failed to find a significant ($p<0.05$) relationship between sample closet inventory and prescribing behavior.
CONCULSIONS: Our research hypothesis was that there would be a significant relationship between inventory and prescribing behavior. Although we cannot "accept" the null hypothesis, the null findings provide encouragement that samples in our clinics does not counterpose efforts in teaching residents quality care and evidence-based prescribing.

48. Medication errors: recognition, reporting, and responsibility from the physician, pharmacist, and nurse perspective. *Holly E. Rogers, Pharm.D.*, Amy C. Alvarez, M.A., C. Andrew Brown, M.D.; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: Evaluate the different perspectives relating to medication error recognition, reporting, and responsibility among individual focus groups comprised of physicians, pharmacists, and nurses.
METHODS: Total of 4 focus groups (2 physician, 1 nurse, 1 pharmacist) were conducted in the fall of 2002. A professional moderator was employed to conduct sessions. Each session was used to elucidate the differences in perspectives relating to medication errors.
RESULTS: The perspectives of medication error recognition, reporting, and responsibility varied greatly among the groups. The definitions given for a medication error were vast and included "Any deviation from the 5 rights," "A mishap in the pharmacy," and "Something that happens that shouldn't have happened." All groups were unsure of the proper methods for reporting medication errors, but each group expressed the importance of reporting. No group felt responsible to report the errors of others; however, pharmacists unanimously expressed their responsibility to recognize but not to report. Physicians voiced nursing responsibility for reporting; however, nurses were reluctant to report for fear of punitive action or retribution.
CONCLUSIONS: The sweeping variations in medication error perspectives shed light on the daunting task of improving patient safety. In order to improve the patient safety environment, every party involved in the medication process must uniformly 1) recognize the occurrence of a medication error, 2) report the occurrence of every error including near misses, 3) accept responsibility for participating in the improvement of the medication process, and 4) remove the punitive nature of medication error reporting.

49. Reducing misclassification errors in field research: the case of many raters. Kimberly A. Galt, Pharm.D., FASHP, *Ann M. Rule, Pharm.D.*, Ronald J. Markert, Ph.D.; Creighton University, Omaha, NE.

PURPOSE: This project describes a process to minimize misclassification errors in a large field research study with many raters. The study is a randomized controlled trial of 80 physicians in primary care practice to observe the impact of PDA-based drug information sources and PDA-generated prescriptions on potential prescribing errors. Accurate classification of the medication error potential for 40,000 outpatient prescriptions, and accurate identification of active problems and medications during the patients office visit is essential. Data was collected over 4 months.
METHODS: A standardized case method combined with a process of educational reinforcement of correct data classification methods was developed to minimize misclassification errors for 14 raters. Education and assessment of rater performance for prescription classification occurred every 2 weeks. Eight different standardized "prescriptions" (SP) with 29 classification criteria were evaluated and κ calculated for interrater agreement. Standardized charts were used at baseline and half way through data collection. Expert chart review criteria were established and the raters'

evaluation compared. An accuracy score based upon errors of omission and commission of chart data was determined (perfect score = 1). Low scorers (< 0.7) were re-instructed.
RESULTS: κ values ranged from 0.89-0.98 (high agreement = > 0.75). Mean accuracy scores for charts 1 and 2 were 0.81 (0.71-0.93) and 0.80 (0.54-1.0). Nine of 13 raters maintained or improved. Four raters had a minor decrease in their performance.
CONCLUSIONS: A standardized case process was successful in minimizing misclassification errors. Supported by the Agency for Healthcare Research and Quality, 1-R18HS11808-01.

50. PDA-based drug information sources: potential to assure medication safety. Kimberly A. Galt, Pharm.D., FASHP; *Ann M. Rule, Pharm.D.*; Creighton University, Omaha, NE.

PURPOSE: This study compared the potential for PDA-based drug information sources to assure medication safety associated with medication errors that are dependent upon specific, accurate and complete drug information at the point of care.
METHODS: Physicians and pharmacists were surveyed to determine the quality standards and usefulness of 16 PDA-based drug information sources. Three sources emerged that most closely met these criteria: Mobile Micromedex®, ePocrates®, and LexiDrugs®. A medication error classification system was then assessed to determine the most common medication error types that were likely to occur because of the lack of availability of accurate, specific, or complete drug information at the point of care. Twenty-six case simulations were created to test the ability of the sources to meet these safety needs. A rating was assigned to each resource; 1 = no information, 2 = inadequate information, 3 = adequate information, 4 = information exceeds need.
RESULTS: The mean ratings for adequacy to meet the information need related to patient safety were 2.9 (LexiDrugs), 2.0 (ePocrates), and 2.1 (Mobile Micromedex), respectively; with LexiDrugs significantly better when compared to Mobile Micromedex (t-test; p=0.001) and ePocrates (t-test; p=0.005). No resource was sufficient for all cases.
CONCLUSIONS: LexiDrugs was the most accurate, specific and complete resource available via PDA to optimize medication safety by reducing potential errors associated with insufficient or incomplete drug information as a possible cause. Specific improvements and recommendations to maximize medication safety are discussed. Supported by the Agency for Healthcare Research and Quality, 1-R18HS11808-01.

51E. Demonstration project on compensation for services and collaborative practice. *J. Chris Bradberry, Pharm.D.*, Pamala J. Reed, D.P.H., Christa George, Pharm.D., Quentin Srnka, Pharm.D., Stephan L. Foster, Pharm.D., Roger Davis, Pharm.D.; University of Tennessee Health Science Center, Memphis, TN; Tennessee Pharmacists Association, Nashville, TN.

Presented at the Annual Meeting of the American Pharmaceutical Association, New Orleans, LA, March 29-April 2, 2003.

52. Clinical pharmacy services in United States hospitals in 2020: core clinical pharmacy services and manpower needs. *C. A. Bond, Pharm.D., FASHP, FCCP*, Cynthia L. Raehl, Pharm.D., FASHP, FCCP, Roland Patry, D.P.H.; Texas Tech University Health Sciences Center, Amarillo, TX.

PURPOSE: This study develops a model for the provision of clinical pharmacy services in our nation's hospitals in 2020.
METHODS: Time estimates for 14 specific clinical pharmacy services were drawn from data provided in the 1989, 1992, 1995, and 1998 National Clinical Pharmacy Services Database surveys. Information on the percent of hospitals providing clinical pharmacy services and the mean number of patients receiving these services was taken from the 1998 National Clinical Pharmacy Services Database. Information on the number of hospitals and patient admissions were taken from the 2000 American Hospital Association. Pharmacist full time equivalents for the provision of these 14 clinical pharmacy services is provided for 1998 and extrapolated forward to 2020. FTE projections are provided for a set of core clinical pharmacy services based on favorable associations with health care outcomes (mortality rates, drug costs, total cost of care, length of stay, and medication errors).
RESULTS: Staffing data from 1998 suggests that 55,294 pharmacist FTE and 52,999 pharmacy technician FTE in United States Hospitals. Data from 1998 show that 17,325 pharmacist FTE were devoted to providing clinical pharmacy services (31% of the 55,294 pharmacist FTE). In order to provide all 14 clinical pharmacy services for 100% of the patients in United States hospitals would require 55,441 clinical pharmacist FTE of which 34,619 FTE would be new. A more realistic projection based on clinical pharmacy services {Drug Information (1633 additional clinical pharmacist FTE), Adverse Drug Reaction Management (59 FTE), Drug Protocol Management (4953 FTE), Medical Rounds Participation (6023 FTE), and Medication Admission Histories(1840 FTE)} that have been shown to be associated with improved health care outcomes would be 14,508 new pharmacist FTE to provide a core set of clinical pharmacy services for 100% of patients in 2020. While the number of pharmacy school graduates were about the same in 1990 and 2000 (7000 graduates) trends with the number of pharmacy schools and pharmacy students suggest that the number of graduates will significantly increase in the future. Additionally, the number of ASHP residents has increased from 435 in 1990 to 896 in 2001 (a 106% increase).
CONCLUSIONS: The development of a national plan to implement a core set of clinical pharmacy services by 2020 would require leadership from pharmacy organizations, state boards of pharmacy, and a commitment from the profession. It appears feasible, based on resident training and pharmacist manpower to implement a core set of clinical pharmacy services for patients in our nation's hospitals by 2020 should the profession wish to.

53. Professional activities, characteristics, and job satisfaction of vaccine-licensed pharmacists in the State of Texas. *Melinda M. Neuhauser, Pharm.D.*, Danielle Arceneaux, Pharm.D., Lynn Simpson, Pharm.D., Kevin W. Garey, Pharm.D.; University of Houston, Houston, TX.

PURPOSE: Pharmacists can receive specialty training and licensure to directly administer vaccinations. How vaccine-licensed pharmacists (VLP) use this specialty training is unknown. The purpose of this research is to document the professional activities and practice site settings of VLP compared to vaccine-unlicensed pharmacists (VUP).
METHODS: 189 VLP identified through the Texas Pharmaceutical Association and 470 randomly selected registered pharmacists (R.Ph.) identified from the Texas State Board of Pharmacy were mailed a 3-part questionnaire. The questionnaire consisted of pharmacist and practice site demographic, involvement in immunization services, and a job satisfaction survey. Nonresponders were mailed identical surveys 3 and 5 weeks after the initial mailing.
RESULTS: 90 of 189 (47.6%) of VLP surveys and 170 of 470 (36%) of R.Ph. surveys were returned. 11 of 170 (6.5%) R.Ph. respondents were VLP for a final cohort of 101 VLP and 158 VUP. Compared to VUP, VLP were more likely to be female (53% vs 41%), Hispanic (23% vs 8%), later graduation (1983 vs 1980), advanced degree (20% vs 13%), or non-staff position (49 vs 34%). Rxs/day and R.Ph./shift were similar. VLP were more involved in immunizations (74% vs 1%). 68% of VLP administered vaccines themselves. Of these pharmacists (n=69), the most frequently administered vaccines were influenza (96%), pneumococcal (77%), hepatitis (55%), and DPT (19%). No significant differences were observed in job satisfaction.
CONCLUSIONS: Pharmacists who undergo specialty training in vaccine licensure are providing clinical services for their patients. Efforts to increase the number of vaccine-licensed pharmacists throughout the USA should be undertaken.

Hematology/Anticoagulation

54. A comparison of six methods of measuring the adequacy of anticoagulation in 14 long-term care facilities. *Hayley Y. Park, Pharm.D.*, Tammy Bungard, Pharm.D., Ross Tsuyuki, Pharm.D., M.Sc.; University of Toronto, Toronto, ON, Canada; University of Alberta, Edmonton, AB, Canada.

One of the most commonly used measures of adequacy of anticoagulation with warfarin is the time spent in the therapeutic range (TTR). There are, however, several methods of calculating TTR, and it is not known how the method used affects TTR.
OBJECTIVE: The primary objective of this study was to compare the TTR by 6 different methods in stable, elderly patients with atrial fibrillation receiving warfarin.
METHODS: This retrospective chart review included patients 65 years old or greater, residing in a long-term care facility for at least 5 days of the week, diagnosed with atrial fibrillation, and prescribed warfarin therapy. Patients were excluded if warfarin had been prescribed for less than 4 weeks. The TTR was calculated using 6 different methods. These 6 methods were divided into 2 categories – methods using the proportion of INRs in therapeutic range (cumulative, cross-section of the files) and methods using the proportion of days in therapeutic range (equidivision, linear interpolation, hybrid, simplified hybrid).
RESULTS: There were 263 (10.9%) residents diagnosed with atrial fibrillation, with 151 (57.4%) prescribed warfarin. For these patients, 2943 INR results representing 104 patient-years of follow-up were analyzed. The calculated TTR was as follows: cumulative (59.3 ± 21.7%), cross-section of the files (64.2%), equidivision (63.5 ± 21.9 %), linear method (64.8 ± 21.8%), hybrid (64.9 ± 21.9 %), and simplified hybrid (69.8 ± 20.1%). There was no statistical difference found between the methods of TTR calculation.
CONCLUSIONS: By selecting a population where factors such as non-compliance, changing medical status, diet and frequency of monitoring are controlled for, we have found that the calculation of TTR by 6 different methods yielded similar results.

55. Vardenafil does not alter aspirin-induced prolongation of bleeding time in normal healthy volunteers: a phase I study. *Arthur Mazzu, Ph.D.*, Prabhu Rajagopalan, Ph.D., Chengua Xia, Ph.D., Phillip Leese, M.D., Pavur Sundaresen, M.D., Ph.D.; Bayer Corporation, West Haven CT; Quintiles Phase I Services, Lenexa, KS.

PURPOSE: Vardenafil is a highly selective PDE-5 inhibitor in development for the treatment of erectile dysfunction (ED). PDE-5 is expressed in penile vasculature and in platelets. Inhibition of PDE-5 may inhibit platelet aggregation. Aspirin inhibits platelet aggregation. Potentially, combined use of PDE-5 inhibitors and aspirin may alter hemostasis. Here, the influence of vardenafil alone, or in combination with aspirin, on bleeding time was evaluated in healthy volunteers.
METHODS: Nineteen men first received single dose vardenafil 10 mg (Day 1), and then randomized to double-blind, two-way crossover study consisting of single dose vardenafil 10 mg or placebo, administered on Days 5 and 8 on the background of low-dose aspirin (162 mg/day on Days 2-8). Bleeding time was measured 1 and 4 hours after vardenafil/placebo dosing by Simplate II technique. Differences were analyzed using ANCOVA.
RESULTS: Baseline bleeding time was 5.43(26) [geometric mean(%CV)] minutes. Vardenafil 10 mg did not alter bleeding time after one [5.63(28) minutes, geometric LS mean ratio (95% CI) of 1.04(0.95-1.13)] or four hours [5.12(19) minutes, geometric LS mean ratio (95% CI) of 0.94 (0.86-1.03)]. Vardenafil did not affect bleeding time when given on an aspirin background.

	Bleeding time, minutes[a]		
	Aspirin + placebo	Aspirin + vardenafil	Geometric LS mean ratio[b] (95% CI)
Predose	7.96 (24%)	7.61 (28%)	
1 hour post-dose	8.93 (35%)	9.17 (27%)	1.04 (0.91–1.17)
4 hours post-dose	8.50 (20%)	9.20 (29%)	1.09 (0.95–1.25)

[a]Geometric mean (%CV); [b]Aspirin + vardenafil/aspirin + placebo

Vardenafil was well tolerated. The most common adverse event was headache.
CONCLUSIONS: In this study, vardenafil did not alter bleeding time when given alone, or on a background of low-dose aspirin.

56E. Effect of access to anticoagulation management services on the rate of utilization of warfarin in atrial fibrillation. Karen M. Merrill, Pharm.D. candidate, *Jill S. Burkiewicz, Pharm.D.*; Midwestern University, Downers Grove, IL.

Presented at the 37th Annual Midyear Clinical Meeting of the American Society of Health-System Pharmacists, Atlanta, GA, December 8-12, 2002.

57. Validation of equations used to predict warfarin dosing decisions. *Kenneth M. Shermock, Pharm.D.,* Jason T. Connor, M.S., Nicole Thomas, B.S., Jodie Fink, Pharm.D., Lee Bragg, Pharm.D.; Johns Hopkins Hospital, Baltimore, MD; Cleveland Clinic Foundation, Cleveland, OH; Brigham Young University, Provo, UT.

PURPOSE: To assess the validity of published formulas that predict clinical (i.e., 'dosing') agreement of INR pairs.
METHODS: 202 patients provided 3 INR measurements for analysis: two from different fingerstick devices and one via reference laboratory. Actual dosing decisions based on these INRs were made by blinded clinicians. The actual dosing agreement between each fingerstick device and the laboratory was used as a standard to assess the agreement predicted by fourteen published, but unvalidated, formulas. Bayesian hierarchical modeling was used to rank the algorithms of their ability to predict actual clinical decisions. An enhanced method used bootstrapped smoothing splines to investigate agreement as a function of POCT INR value.
RESULTS: The formulas misclassified dosing agreement for between 19% and 38% of paired INR values (mean: 27%). Formulas generally misclassified fewer pairs for the device with less bias (range: 16%-30%) than more bias (range 23%-44%). The method that offered the best proxy (posterior probability of being the best method = 70%) still misclassified 19% of INR pairs. The smoothing spline analysis showed that the misclassification of pairs by these formulas varies inconsistently throughout the INR scale. We developed an improved formula too complex for likely clinical use.
CONCLUSIONS: The unvalidated formulas routinely used to predict warfarin dosing decision agreement misclassify a significant proportion of paired INR values. More accurate formulas are too complex to be practical. Therefore, dosing decisions should be measured directly as opposed to predicted with a formula.

58. An evaluation of the variability in interpersonal relationships between plasma heparin concentrations and two clotting time tests. *John M. Koerber, B.S.,* Maureen A. Smythe, Pharm.D, Sarah V. Muench, Pharm.D., Robert L. Begle, M.D., Joan C. Mattson, M.D.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

BACKGROUND: Recommendations for heparin monitoring indicate the aPTT therapeutic range should be derived by performing linear regression analysis on paired heparin and aPTT data points in patients receiving heparin. The aPTT therapeutic range is the aPTT values which correlate to a heparin level of 0.3-0.7 units/ml (by anti-factor Xa). Several investigators have reported poor correlations between heparin concentrations and aPTT which often lead to inappropriate heparin dose adjustment decisions. We hypothesize that significant interpersonal (between patients) variability exists in the intrapersonal (within a patient) relationship between heparin levels and aPTT results. This variability may explain the poor overall correlation and disconcordant heparin dosage adjustment decisions.
PURPOSE: To evaluate the interpersonal variability in the intraperson relationship between heparin concentrations and activated partial thromboplastin time (aPTT) results.
METHODS: This was a prospective pilot study enrolling 10 patients on continuous infusion heparin. Patients with conditions known to affect aPTT were excluded. Heparin infusions were adjusted based on standard hospital protocol. Four to six serial blood samples were drawn every 4 hours within a 24-hour period. A total of 8.5 milliliters was drawn for each sample to determine bedside aPTT, laboratory based aPTT and heparin concentration (anti-factor Xa analysis). Each patient's aPTT results were correlated with the corresponding heparin levels using linear regression.
RESULTS: Ten patients (4M, 6F) were enrolled with a mean age of 69.4 ± 16.6 years and mean weight of 74.0 ± 21.1 kg. Two patients were excluded because heparin was discontinued within four hours. An average of 5.3 blood draws per patient were performed on the remaining subjects (range 4–6).
Correlation of Heparin Levels to aPTT values

Patient	Laboratory aPTT	Bedside aPTT
1	0.57	0.20
3	0.90*	0.80
4	0.79	0.73
5	0.39	0.42
6	0.95*	1.00*
7	0.81	0.68
8	0.84	0.63
9	0.35	0.82

*Significant correlation

CONCLUSIONS: A significant correlation between heparin levels and aPTT values was not reached in the majority of patients. Significant interperson variability in the intrapersonal relationship between heparin levels and aPTT values was evident. These findings may explain previous results of the poor overall correlation between heparin levels and aPTT values as well as the inappropriate heparin dose adjustment decisions.

59. Developing guidelines for the use of enoxaparin in patients with renal dysfunction. *Nikki L. Milan, Pharm.D.,* Jeffrey Gerak, Alison Tran, Pharm.D.; Harper University Hospital; Wayne State University, Detroit, MI.

PURPOSE: Pharmacokinetic data suggest that clearance of enoxaparin may be reduced by 30% in patients with renal impairment. Although the manufacturer cautions against using enoxaparin in patients with renal failure, occasions may arise in which other options are not viable. Anti-Xa levels recorded on renally impaired patients receiving enoxaparin were collected and guidelines developed for the use of enoxaparin in these patients.
METHODS: A retrospective chart review of patients with anti-Xa levels reported over a 21 month period was conducted. Creatinine clearance (CLcr), dose and time of enoxaparin, and timing of anti-Xa levels were assessed. Patients with CLcr ≤ 30 ml/minutes with anti-Xa levels drawn 3-6 hours after an enoxaparin dose were included. Four-hour, post-dose anti-Xa levels were considered therapeutic if between 0.5-1.0 units/ml for q12h, and 1.0-1.5 units/ml for q24h regimens. Dosing guidelines were developed based on enoxaparin dosages that achieved desired levels.
RESULTS: Of the 58 recorded anti-Xa levels, 29 met criteria for analysis. Enoxaparin was empirically dose-adjusted in 86% of the cases, with 56% providing therapeutic anti-Xa levels. The average dose achieving desired anti-Xa levels was 0.78 mg/kg q12h and 1.20 mg/kg q24h. Therapeutic levels were obtained in 73% of patients receiving > 5 doses. For patients with subtherapeutic levels, 71% received < 5 doses.
CONCLUSIONS: Guidelines for enoxaparin use in patients with renal dysfunction were developed based on average dosage adjustment and timing of therapeutic anti-Xa levels. The data suggest that a 20-25% dosage reduction is prudent if patients receive prolonged therapy. Monitoring of anti-Xa levels is recommended for these patients.

60E. Delayed onset heparin-induced thrombocytopenia. *Maureen A. Smythe, Pharm.D.,* Jennifer L. Stephens, B.S., John M. Koerber, B.S., Joan C. Mattson, M.D.; William Beaumont Hospital; Wayne State University, Detroit, MI.

Published in Crit Care Med 2001;2002(suppl)29:A97.

61E. Evaluation of point-of-care devices in the catheterization laboratory. *Maureen A. Smythe, Pharm.D.,* John M, Koerber, B.S., Sandra Nowak, Pharm.D., Susan J. Westley, M.T., Joan C. Mattson, M.D.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

Published in Crit Care Med 2001;2002(suppl)29:A97.

62. The effect of lepirudin on the international normalized ratio. *Jennifer Stephens, B.S.,* Maureen A. Smythe, Pharm.D., John M. Koerber, B.S., Joan C. Mattson, M.D.; William Beaumont Hospital; Wayne State University, Detroit, MI.

INTRODUCTION: Many patients on direct thrombin inhibitor (DTI) therapy require transition to warfarin therapy. This transition can be complicated by DTI induced elevations in the INR. While the effect of argatroban on the INR

has been characterized, data on the effect of lepirudin on the INR are lacking.
PURPOSE: The objective of this project was to determine the effect of lepirudin on the INR.
METHODS: Patients receiving Lepirudin who were being transitioned to warfarin therapy between January 2000 and May 2001 were retrospectively identified. Patients with elevated baseline aPTT times or those with a known underlying inherited hypercoagulable disorder or antiphospholipid syndrome were excluded. Lepirudin therapy was titrated to achieve an aPTT of 1.5-2.5 times either the patient's baseline aPTT or the mean laboratory normal aPTT. Prior to the start of warfarin therapy, paired aPTT and INR data were collected. Linear regression graphs were constructed to identify the INR which corresponded to an aPTT time of 45-75 seconds (1.5-2.5 x mean laboratory normal of 30 seconds). During the study period, Organon MDA Platelin L was used for the aPTT and Organon Simplastin L was used for the PT. The International Sensitivity Index (ISI) of the Simplastin L thromboplastin was 2.0.
RESULTS: Ten lepirudin patients were transitioned to warfarin during the study period. Fifty-five paired aPTT and INR data points were available prior to initiation of warfarin therapy. The correlation between aPTT and INR was 0.77. An aPTT of 45 to 75 seconds on lepirudin corresponded to an INR of 1.7 to 3.2. These INR prolongation effects were observed in the absence of warfarin administration. The mean lepirudin dose was 0.055 ± 0.05 mg/kg/hour.
CONCLUSIONS: When using a thromboplastin with an ISI of 2.0, lepirudin significantly prolongs the INR in the absence of warfarin. These effects have not been previously reported and may complicate the transition from lepirudin to warfarin therapy.

63. Emergency department clinical pharmacist improves safety and efficacy of weight-based heparin dosing nomogram in achieving anticoagulation. *Victor Cohen, B.S., Pharm.D., CMI-V,* Samantha P. Jellinek, Pharm.D., William Goldman, Pharm.D., Antonios Likourezos, M.A., MPH; Arnold and Marie Schwartz College of Pharmacy and Health Sciences; Maimonides Medical Center, Brooklyn, NY.

PURPOSE: This study was conducted to determine if an Emergency Department Pharmacist Directed Heparin Weight-Based Dosing Nomogram (EDP-HWBN) achieves therapeutic aPTT's more often and with quicker onset than no pharmacist direction.
METHODS: The primary endpoint was the percentage of therapeutic aPTT's achieved by the EDP-HWBN vs no pharmacist direction (control group). The secondary endpoint was the time until therapeutic aPTT is achieved (hours). The Chi-Square test was used to compare the primary endpoint of therapeutic aPTT's, and the Mann-Whitney test was used to compare the median time to achieve a therapeutic aPTT between the groups. The level of significance were tested at $p<0.05$.
RESULTS: EDP-HWBN significantly improved the rates of therapeutic aPTT's as compared to the control group. Of the 397 aPTT's assessed, the EDP-HWBN group achieved a therapeutic rate of 56.7% while the no pharmacist directed heparin weight based nomogram group achieved a therapeutic rate of 34.7% ($p<0.01$). The median time to achieve a therapeutic aPTT was 10 hours for the EDP-HWBN and 23 hours for the no pharmacist directed weight based heparin nomogram, and this was statistically significant ($p<0.05$).
CONCLUSIONS: Use of a weight-based heparin nomogram may improve the rate of achieving therapeutic aPTT's, however due to patient factors, drug factors, and hospital factors, the rate of achieving therapeutic aPTT's may be less than optimal. Instituting an EDP-HWBN with a computerized decision support algorithm may improve rates of therapeutic aPTT's and time to achieve a therapeutic aPTT.

64. Characteristics of patients with high INR values in an anticoagulation clinic. *Jennifer S. Chonlahan, Pharm.D.,* Dawn E. Havrda, Pharm.D., BCPS, Toni L. Ripley, Pharm.D., BCPS; University of Oklahoma Health Sciences Center; Coumadin Clinic, Oklahoma City, OK.

PURPOSE: To evaluate characteristics of patients with INRs ≥ 5 and their risk factors for thrombosis and bleeding.
METHODS: In an outpatient pharmacy anticoagulation clinic, we conducted a retrospective chart review of 48 patients receiving warfarin who had an INR ≥ 5 between December 1998 to July 2001. The Chi-square test or McNemar's test was used to determine the significance of the different patient characteristics.
RESULTS: 72 events of excessive anticoagulation were found among 48 patients. Mean age was 50.8 ± 13.1 with 78% female. Majority of indications for anticoagulation were venous thromboembolism and mechanical heart valve. Percent distribution of insurance coverage: Medicaid 43.8%, private insurance 30.4%, Medicare 16.4%, no insurance 12.3%. Patients in lower socioeconomic class, defined as Medicaid or no insurance, were more likely to have INRs ≥ 5 compared to patients with Medicare ($p<0.001$) or private insurance ($p<0.001$). Mean INR at last clinic visit before excessive anticoagulation was 2.85 ± 1.04. Mean current weekly warfarin dose was 47.5 mg/week ± 25.3. Mean time on current weekly dose was 6.2 weeks ± 7.7. The major reasons for increased INR values were unknown, drug interactions, and decreased vitamin K intake. Total percent incidence of minor bleeding events was 13.9% of INRs. No major bleeding events occurred. The patients that had bleeding events were more likely to have risk factors for bleeding ($p=0.053$).
CONCLUSIONS: Patients with INR values ≥ 5 were more likely to be in a lower socioeconomic class. They had a low occurrence of bleeding events, however, if a bleeding event occurred they tended to have risk factors for bleeding.

Herbal Medicine

65. Protective effects of the antioxidant, Ginkgo biloba extract, and the protease inhibitor, aprotinin, against *Leiurus quinquestriatus* scorpion venom-induced tissue damage. *Amal J. Fatani, Ph.D.,* Amal A. Abdel-Fattah, Ph.D., Feiruz E. Mohammed, Ph.D., Hana H. Al-Zuhair, Ph.D., Hazar I. Yaqub, Ph.D., Musheera Ibrahim, Ph.D.; King Saud University, Riyadh, Saudi Arabia.

PURPOSE: The ability of (a) the antioxidant "standardized extract of gingko biloba plant (EGb 761)" and (b) the non-selective protease inhibitor, aprotinin, in ameliorating venom-induced biochemical alterations indicative of cellular injury and oxidative stress were studied, to determine their effectiveness in protecting rats from venom-evoked cellular damages.
METHODS: Lungs and hearts were excised 60 minutes after decapitating rats (n= 8/group) injected with *Leiurus quinquestriatus* scorpion venom (*LQQ*, 0.25 mg kg^{-1}, s.c.) alone or after pretreatment with aprotinin (46000 K.I.U kg^{-1}, i.p., 10 minutes before venom), EGb (150 mg kg^{-1}, PO, 3 weeks before venom), or a combination of both. Separate control groups were injected with diluents or selected treatment modalities alone. Two oxidative stress parameters: lipid peroxides (LP) and reduced glutathione (GSH) were measured. Lung edema index (lung/ body weight x 100) was calculated.
RESULTS: Pretreatment with EGb attenuated *LQQ* venom-evoked increases in GSH and LP in rat hearts and lungs (each $p<0.05$ vs venom alone, ANOVA). The protective effects of EGb were potentiated when combined with aprotinin where the venom-elicited elevations in lung GSH and heart plus lung LP were reduced ($p<0.01$ vs venom) more than that seen with EGb alone. The combined treatment was also superior in attenuating the venom-induced increased lung edema ($p<0.01$ vs venom) than either drug alone ($p<0.05$ vs venom).
CONCLUSIONS: The antioxidant EGb, especially when combined with the protease inhibitor aprotinin, attenuated venom-produced elevation in GSH and LP levels, plus the index for lung edema, indicating the involvement of oxidative stress and proteases in venom-evoked cellular damages seen in the rat heart and lung tissues.

66. Bi-national evaluation of herbal providers in the El Paso, Texas/Ciudad Juarez, Mexico border region. *Jose O. Rivera, Pharm.D.,* Armando Gonzalez Stuart, Ph.D., Jose C. Rodriguez, CPhT; University of Texas Austin/El Paso Cooperative Pharmacy Program, Austin, TX.

PURPOSE: To evaluate and compare the primary herbal products employed, their origin, and their uses in both border cities.
METHODS: A bilingual questionnaire was given to herbal providers in El Paso (n=16), Texas and Ciudad Juarez (n=20), Mexico to find out which herbal products or "nutraceuticals" were more commonly used, what they contained, their place of origin and what illnesses they were recommended for.
RESULTS: In El Paso, 83 herbal products are currently considered popular. The top 5 products sold were: Noni, Fibra Kania, Glucosamine, Protein supplements and Cascara Sagrada. In Ciudad Juarez, 98 herbal or natural products are considered to be of popular use. The top 5 products sold were: Arnica, Horsetail, Cuachalalate, Gordolobo and Orange tree blossom. The majority of the natural products sold in El Paso (98 %) are from the United States, while most of the products sold in Ciudad Juarez (89.6 %) are from Mexico. Comparing these results we observed that the population of El Paso tends to consume herbal or natural supplements destined for weight loss or muscle enhancement, while the herbal products consumed in Juarez are mostly crude plants employed for the treatment illness.
CONCLUSIONS: Although Ciudad Juarez, Mexico and El Paso, Texas are bordering cities, the herbal products consumed by their respective populations are quite distinct, both in terms of content as well as in their method of employment.

HIV/AIDS

67. Characterization of the ritonavir-nelfinavir pharmacokinetic interaction in pediatric patients with advanced HIV disease using a mixed effects modeling approach. *Edmund V. Capparelli, Pharm.D.,* Sandra K. Burchett, M.D., Andrea Kovacs, M.D., Margaret Khoury, M.D., Rebecca Oyomopito, M.S., Lynne M. Mofenson, M.D., NICHD, Bonnie Zimmer, B.A., Diane T. Holland M.Phil.; University of California at San Diego, San Diego, CA; Children's Hospital of Boston, Boston, MA; University of Southern California, Los Angeles, CA; Harvard University, Boston, MA; Frontier Science and Technology Research Foundation, Buffalo, NY, San Diego Pediatric Pharmacology Research Unit, La Jolla, CA.

PURPOSE: Combination protease inhibitors have become common therapy for pediatric patients with advanced HIV disease. This study characterizes the effects of ritonavir (RTV) and age on nelfinavir (NFV) pharmacokinetics in infants and children using in a mixed effects modeling approach.
METHODS: 134 pediatric subjects (average age 8.0, range 0.6-21 years) on quadruple drug therapy including NFV 30 mg/kg with NVP (120 mg/m^2) and/or RTV (350 mg/m^2) were included. 36 subjects had intensive sampling (6 levels) around an observed dose while the remaining samples were randomly collected. A total 513 NFV concentrations were analyzed using NONMEM (V.I). A mixture model was used to identify subjects with suspected recent non-adherence. NFV and RTV concentrations were determined by HPLC method.
RESULTS: Typical NFV CL/F and Vd/F were 10.4 L/kg and 4.05 L/kg$^{(0.75)}$, respectively. Very low NFV concentrations (most < 0.11 µg/ml) indicated recent non-adherence in 26% of random samples despite contrary dose information provided by their parents/guardians. Age less than two years was associated with a 60% reduction in absorption. Use of concomitant RTV therapy as a categorical variable did not significant impact NFV pharmacokinetics. However, a RTV concentration-dependent inhibition E_{MAX} model greatly improved the fit (EC_{50} 2 µg/ml).
CONCLUSIONS: RTV reduces NFV apparent clearance in children in a concentration dependent manner. However, high variability in RTV levels results in inconsistent increases in NFV exposure in children. The variably of this RTV effect along with suspected non-adherence to NFV (and RTV) therapy suggest measurement of NFV concentrations is necessary to ensure adequate drug exposure in this population.

68. One-year incidence of diabetes mellitus, dyslipidemia, and hypertension in an HIV-infected managed care population. *Theodore Darkow, Pharm.D.,* Christina L. Fontes, M.S., Anne V. Tuomari, M.S., Uchenna H. Iloeje, M.D., MPH, FACP; Prescription Solutions, Costa Mesa, CA; Bristol-Myers Squibb, Plainsboro, NJ; Bristol-Myers Squibb, Wallingford, CT.

PURPOSE: Metabolic abnormalities (MA) including diabetes mellitus (DM), dyslipidemia, and hypertension (HTN) have emerged as complications of HAART and greatly impact health expenditures in non-HIV infected patients. We describe the one-year incidence of MA in newly diagnosed HIV+ patients and a matched cohort of non-infected individuals.
METHODS: Pharmacy and medical claims from a large MCO in the Western US were used. Adults (≥ 18) with one inpatient or two outpatient HIV claims or two antiretroviral claims with a cumulative days' supply > 30 days between July 1999 and June 2000 were eligible. Patients with prior claims for HIV, DM, HTN, or dyslipidemia were excluded. These patients were then matched 3:1 on age, gender, and state. Unadjusted rates are reported; Chi-square and logistic regression were performed.
RESULTS: There were 1,368 controls and 456 HIV+ patients identified. Mean age was approximately 40 years, and 86% were males. Approximately one-third of HIV+ patients were exposed to a protease inhibitor (PI). Incidence rates in HIV vs control cohorts were: DM (2.2% vs 1.4%), dyslipidemia (4.2% vs 3.9%), and HTN (5.5% vs 4.4%). Incidence rates in PI-exposed vs non-exposed HIV+ patients were: DM (2.8% vs 1.9%), dyslipidemia (5.7% vs 3.5%), and HTN (6.4% vs 5.1%). No differences were statistically significant.
CONCLUSIONS: The incidence of each MA was greater in newly diagnosed HIV+ patients than in controls and in PI-exposed than non-exposed HIV+ patients. Although not statistically significant due to sample size limitations, the increased rates of these important diseases in this HIV population are clinically significant.

69. The effect of non-antiretroviral enzyme-inducing agents on virologic control in HIV-infected patients on highly active antiretroviral therapy. *Kimberly K. Scarsi, Pharm.D.,* Michael J. Postelnick, B.S.; Northwestern Memorial Hospital, Chicago, IL.

PURPOSE: In HIV-infected patients, drug interactions which result in insufficient concentrations of protease inhibitors (PIs) and non-nucleoside reverse transcriptase inhibitors (NNRTIs) have been associated with virologic failure. To date, little is known about the effect of non-antiretroviral (NARV) CYP3A4-inducers upon NNRTI or PI-based HAART. We sought to identify the incidence of virologic failure in patients concurrently receiving HAART and NARV inducing agents.
METHODS: From a 1300 patient database, 21 patients were identified as being on a NARV CYP3A4-inducing agent, concurrently with a PI or NNRTI. Patient data were retrospectively collected including antiretroviral regimen, time on regimen, reason for discontinuing regimen, adherence as documented by primary physician, CD_4 and viral load measurements during treatment. Virologic control was defined as plasma HIV RNA < 400 c/ml for ≥ 24 weeks.
RESULTS: 21 patients receiving NARV CYP3A4-inducing agents with PIs or NNRTIs were identified. Patients had a mean age of 43 years, median time since HIV diagnosis of 8 years, 60% male, median CD_4 132 cells/ml, and median HIV RNA 19,601 c/ml. The enzyme inducing agents encountered were rifabutin, phenytoin, phenobarbital, carbamazepine, St. John's Wort, and pioglitazone. At 24 weeks, 57% of patients failed to maintain virologic control.
CONCLUSIONS: Virologic control may be difficult to achieve with PI and NNRTI-based regimens in the presence of concurrent NARV CYP3A4-inducers. Further study is required to determine the need for dose modification of NNRTIs and PIs when used in combination with NARV CYP3A4-inducers and/or the utility of therapeutic drug monitoring in this setting.

70E. Simplification of protease inhibitor-based highly active antiretroviral regimens with abacavir improves hyperlipidemia and maintains viral suppression in HIV-1 infected adults (ESS40003). P. Keiser, M.Ension, E. DeJesus, A. Rodriguez, J. Olliffe, V. Williams, J. Snidow, A. Shachoy-Clark, *J. Fleming*; University of Texas Southwestern Medical Center, Dallas, TX; North Broward Hospital, Ft. Lauderdale, FL; IDC Research Initiative, Altamonte Springs, FL; University of Miami, Miami, FL; Swedish Hospital, Seattle, WA; GlaxoSmithKline, Research Triangle Park, NC.

Presented at the XIV International AIDS Conference, Barcelona, Spain, July 7-12, 2002.

71E. The NEAT study: GW433908 efficacy and safety in ART naïve subjects, preliminary 24-week results. A. Rodriguez-French, J. P. Nadler on behalf of the NEAT Study Team, *Sandy Griffith, Pharm.D.*; San Fernando Hospital, Panama City, Panama; University of South Florida, Gainesville, FL.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

72E. CT scan findings at 48 weeks confirm further regression of lipoatrophy following the substitution of stavudine with either abacavir or zidovudine. G. McComsey, D. Ward, S. Hessenthaler, T. File, S. Ross, J. Hernandez, *Julie Fleming, Pharm.D.*; Case Western Reserve, Cleveland, OH; Dupont Circle Physicians Group, Washington, DC; GlaxoSmithKline, Research Triangle Park, NC; Summa Health Systems, Akron, OH.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

73E. Comparable antiviral efficacy and safety of lamivudine administered 300 mg once-daily versus 150 mg BID both in combination with zidovudine (300 mg BID) and efavirenz (600 mg QD) in HIV-1 infected, antiretroviral-naïve adults: EPV20001. E. DeJesus, B. Grinsztejn, K. Gough, D. McCarty, D. Shortino, D. Thomas, S. Castillo, S. Madison, S. Hetherington, *Christina Hill-Zabala, Pharm.D.*; IDC Research Initiative, Altamonte Springs, FL; Evando Chagas Hospital, Rio de Janeiro, Brazil; St. Michael's Hospital, Toronto, ON, Canada; GlaxoSmithKline, Research Triangle Park, NC.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

74E. Pharmacodynamic effects of zidovudine 600 mg once daily versus zidovudine 300 mg twice daily in therapy-naïve HIV-infected patients (COD20002). Peter Ruane, Gary Richmond, Edwin DeJesus, *Christina Hill-Zabala,* Susan Danehower, Qiming Liao, Judy Johnson, Mark Shaefer; Tower ID Medical Associates, Los Angeles, CA; North Broward Hospital, Fort Lauderdale, FL; IDC Research Initiative, Altamonte Springs, FL; GlaxoSmithKline, Research Triangle Park, NC.

Presented at the XIV International AIDS Conference, Barcelona, Spain, July 7-12, 2002.

75E. Lack of recurrence of asymptomatic and symptomatic hyperlactatemia when stavudine is replaced by either abacavir or zidovudine: 48-week data. T. Lonergan, G. McComsey, S. Hessenthaler, P. Shalit, T. File, V. Williams, J. Hernandez for the ESS40010 (TARHEEL) Study Team, *Julie Fleming, Pharm.D.*; University of California at San Diego Antiviral Research Center, San Diego, CA; Case Western Reserve, Cleveland, OH; GlaxoSmithKline, Research Triangle Park, NC; Swedish Medical Center, Seattle, WA; Summa Health System, Akron, OH.

Presented at the 4th International Workshop on Adverse Drug Reactions and Lipodystrophy in HIV, San Diego, CA, September 22-25, 2002.

76E. Potential impact of once daily regimens on adherence to HAART. Valerie Stone, *Jamie Jordan,* Jerry Tolson, Tom Pilon; Massachusetts General Hospital, Boston, MA; GlaxoSmithKline, Research Triangle Park, NC; TRAC, Inc., Carolton, TX.

Presented at the Annual Meeting of the Infectious Disease Society of America, Chicago, IL, October 24-27, 2002.

77E. Efficacy and safety of GW433908/ritonavir once daily in therapy naïve subjects, 48-week results: the SOLO Study. D. Schurmann, J. Gathe, I. Sanne, R. Wood on behalf of the SOLO Study Team, *Sandy Griffith, Pharm.D.*; Charite University Hospital, Berlin, Germany; Therapeutic Concepts, Houston, TX; Infectious Diseases Clinical Trial Unit, Parktown, South Africa; Somerset Hospital, Cape Town, South Africa.

Presented at the 6th International Congress on Drug Therapy in HIV, Glasgow, United Kingdom, November 17-21, 2002.

78E. A two-way drug interaction between lopinavir/ritonavir and phenytoin. *Michael L. Lim, Pharm.D.,* Sherene S. Min, M.D., Joseph J. Eron, M.D., Richard Bertz, Ph.D., Marjorie Robinson, Pharm.D., Andrea Gaedigk, Ph.D., Angela D.M. Kashuba, Pharm.D.; University of North Carolina, Chapel Hill, NC; Abbott Laboratories, Abbott Park, IL; Children's Mercy Hospital, Kansas City, MO.

Presented at the 10th Conference on Retroviruses and Opportunistic Infections, Boston, MA, February 10-14, 2003.

79. Prevalence of smoking and depression in HIV-positive patients in Spokane, WA. *Colleen M. Terriff, Pharm.D.;* Washington State University, Spokane, WA.

PURPOSE: This study determined demographic, smoking and depression information in HIV-positive (HIV+) patients and examined the correlation of smoking history and patient's HIV outlook with depression.
METHODS: A two page survey was developed questioning demographic, HIV history and outlook, antidepressant medications, smoking and quitting information. In addition, patients completed a 21 question Beck Depression Inventory II (BDI-II). All HIV+ individuals in Spokane, Washington were eligible and enrollment was 03/01-04/02. 100 patients completed both parts and were reimbursed for their time. BDI-II mean scores are reported.
RESULTS: Most participants were enrolled at clinic visits and were predominantly non-VA, non-incarcerated patients. In our 84 males and 16 females, 70 currently smoke (BDI-II 18), 13 never smoked (BDI-II 9) and 17 previously smoked (BDI-II 11). 77 patients were taking HAART. 65 believe that HIV is chronically manageable (BDI-II score 14), 20 believe it is a terminal illness (BDI-II score 24) and 15 are indifferent (BDI-II 15). 40% take some form of prescription antidepressant (55% take an SSRI) and 7% take St. John's Wort. 54% drink alcohol and 29% use marijuana. Amount smoke(d)/day: 31 patients <1 pack, 25 1 pack, 31 >1 pack. 46 patients smoke(d) for >20 years. Main reason to start smoking was that family or friend smoked (62%). 66% of smokers want to quit.
CONCLUSIONS: Smoking rates in HIV+ patients in Spokane is surprisingly high. Most smokers have mild depression, and those patients with poor HIV outlook have moderate depression. Smoking cessation programs need to be designed for this specific patient population.

Infectious Diseases

80. Clinical and economic analysis of patients with methicillin-sensitive and methicillin-resistant *Staphylococcus aureus* infections. *Brian J. Kopp, Pharm.D.,* David E. Nix, Pharm.D., Edward P. Armstrong, Pharm.D.; University of Arizona, Tucson, AZ.

PURPOSE: This study evaluated differences in clinical and economic outcomes between patients with infections caused by methicillin-sensitive *Staphylococcus aureus* (MSSA) and methicillin-resistant *Staphylococcus aureus (*MRSA).
METHODS: This study was a retrospective, pair-wise matched case control chart review study. Medical records of patients with documented *Staphylococcus aureus* infections between January 1, 1999 and December 31, 2000 were reviewed for inclusion. Patients with infections caused by MRSA were matched to patients with infections caused by MSSA based on age, site of infection, and type of care. Outcome data collected included hospital length of stay (LOS), antibiotic-related LOS, ICU LOS, hospital cost, patient charge, and duration of mechanical ventilation.
RESULTS: Thirty-six patients with MRSA infections were matched to patients with MSSA infections. There were not any significant differences in baseline characteristics, including Sequential Organ Failure Assessment (SOFA) score, between the two groups. The mean LOS and antibiotic-related LOS were significantly longer in patients with MRSA infections compared to MSSA infections (17.4 days vs 10.4 days, $p<0.03$; 11.2 days vs 6.1 days, $p<0.01$, respectively). Hospital cost associated with treatment of MRSA infections was significantly higher compared to treatment of MSSA infections ($24,835 vs $13,338, $p<0.05$). The differences in ICU LOS, patient charge, and duration of mechanical ventilation were not statistically different between the two groups.
CONCLUSIONS: Patients with MRSA infections had longer LOS and higher total hospital costs compared to patients with MSSA infections. This study reveals important clinical and economic implications for the prevention of antimicrobial resistance and spread of infection due to resistant organisms.

81E. Once-daily extended release ciprofloxacin vs conventional twice-daily ciprofloxacin for the treatment of complicated urinary tract infections of acute uncomplicated pyelonephritis. David A. Talan, M.D., Ira W. Klimberg, M.D., Lindsay E. Nicolle, M.D., Deborah A. Church, M.D., *Steven F. Kowalsky, Pharm.D.,* James Song, Ph.D., Stacy J. Childs, M.D.; University of California at Los Angeles Medical Center, Olive View, Sylmar, CA; Florida Foundation for Healthcare Research, Ocala, FL; Health Sciences Centre, University of Manitoba, Winnipeg, Manitoba, Canada; Bayer Corporation, West Haven, CT; Wyoming Research Foundation, Cheyenne, WY.

Presented at the Annual Meeting of the American Urological Association, Chicago, IL, April 26-May 1, 2003.

82. In vivo activity of levofloxacin against isolates of *Streptococcus pneumoniae* possessing parC and parC/gyrA mutations. *Erika J. Ernst, Pharm.D.,* Michael E. Klepser, Pharm.D., Gary V. Doern, M.D.; University of Iowa, Iowa City, IA.

PURPOSE: Evaluate the activity of levofloxacin against Streptococcus pneumoniae (SPN) isolates having various resistance determinants.
METHODS: Five levofloxacin doses were studied in a murine lung infection model against eight isolates of SPN, four containing parC mutations and four containing mutations in both parC and gyrA regions. Mice were rendered neutropenic and renal failure induced to prolong the half-life of levofloxacin. The pharmacokinetic profile of each dosing regimen (10, 100, 120, 140, and 400 mg/kg) was determined. Mice were infected by intratracheal inoculation of $5x10^7$CFU/ml of SPN. Treatment was initiated twelve hours after infection by oral gavage twice daily for 72 hours. Survival was assessed at regular intervals for up to ten days. Three mice from each group were sacrificed at day 3 for quantification of SPN in the lungs. Relationships between median survival time (MST), percent survival at end of treatment and colony counts were fit using linear regression. The relationships between AUC:MIC or Peak:MIC with the outcomes percent survival, MST and colony counts were fit using a sigmoid E_{max} model.
RESULTS: Percent survival and MST were linearly related to colony counts of SPN (R^2 = 0.36; 0.40, respectively). C_{max}:MIC and AUC:MIC were both significantly correlated with all outcome measures (percent survival, MST and colony count) with the strongest correlation observed between the pharmacodynamic parameter and colony counts (R^2 = 0.51 C_{max}:MIC; 0.41 AUC:MIC. Separating the isolates by resistance determinant (parC or parC/gyrA), the correlations were statistically significant for isolates expressing parC but not for the two-step mutants.
CONCLUSIONS: The pharmacodynamic parameters C_{max}:MIC and AUC:MIC are related with all outcome measures. While the pharmacodynamic parameters are related to outcome, this relationship is not observed when the organism exhibits high-level resistance.

83E. Implementing the NCCLS M-39 guidelines for antibiograms: impact on resistance rates. Rebecca T. Horvat, Ph.D., *Melinda K. Lacy, Pharm.D.,* Dennis W. Grauer, Ph.D., Neil E. Klutman, Pharm.D.; University of Kansas Medical Center, Kansas City, KS; Ortho McNeil Pharmaceutical, Lawrence, KS.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 2002.

84. The effect of ceftazidime restriction on *Pseudomonas aeruginosa* resistance to β-lactam antibiotics in a large teaching hospital. *Randolph E. Regal, Pharm.D.,* Daryl D. DePestel, Pharm.D., Heather L. VandenBussche, Pharm.D.; University of Michigan Hospital, Ann Arbor, MI; Ferris State University, Bronson Methodist Hospital, Kalamazoo, MI.

PURPOSE: To correlate changes in β-lactam use-volumes over a seven-year period (1995-2001) with subsequent *Pseudomonas aeruginosa* (PSA) resistance patterns prior to and after implementation of a clinical pharmacist-facilitated Antibiotic Restriction Program (ARP). The ARP was begun in mid-1997.
METHODS: Purchasing data from 1995-2001 was used to determine average grams purchased per month for ceftazidime (CTZ), piperacillin (PIP), piperacillin-tazobactam (P/T), aztreonam (AZT), and imipenem-cilastatin (I/C). Use-volumes were compared using the Student's t-test. Institutional PSA susceptibility trends for the aforementioned β-lactams plus ciprofloxacin (CPX) and tobramycin (TOB) were also recorded for 1995-2001. Percentages of resistant isolates were compared using Chi-squared analysis for the time periods of 1995-1996 and 2000-2001 for each agent except P/T, for which there was no data prior to 1998.
RESULTS: Use-volumes comparison of 1995-1996 with 1998-2001 showed prescribing levels remained similar for all β-lactams other than CTZ, where there was a 52% decline ($p=0.03$). Meanwhile, PSA resistance declined from 24 to 11.8% for CTZ, 32.5 to 18.5% for PIP, 29.5 to 16.5% for AZT, and 20.5 to 12.3% for I/C (all $p\leq 0.001$). PSA resistance to TOB and CPX remained unchanged ($p=0.62$ and $p=0.31$, respectively).
CONCLUSIONS: A comprehensive pharmacist-facilitated ARP elicited a 52% reduction in CTZ use and kept other anti-pseudomonal β-lactam antibiotic prescribing at steady levels. This correlated with a significant improvement in PSA resistance trends for CTZ and all other anti-pseudomonal β-lactams for four years after post-ARP implementation.

85E. A trough-only vancomycin monitoring program at a university teaching hospital. *Laurel S. Fields, Pharm.D., M.S., BCOP,* Joseph S. Bubalo, Pharm.D., BCOP, BCPS, Daniel R. Touchette, Pharm.D., M.A., Karen B. Farmer; Oregon State University at Portland; Oregon Health and Science University, Portland, OR.

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86. Pharmacodynamic activity of colistin against multi-drug resistant *Acinetobacter baumanii-calcoaceticus* complex. *Sandy J. Close, Pharm.D.*, Steven J. Martin, Pharm.D., BCPS, Diane M. Cappelletty, Pharm.D.; University of Toledo, Toledo, OH.

PURPOSE: New drug development against multi-drug resistant (MDR) gram-negative organisms is lacking, leading to the revival of drugs previously abandoned due to toxicity, such as colistin. While colistin has been available for many years, not much data is currently available on the pharmacodynamics (PD) of this agent. This study evaluated the PD activity of colistin against MDR *Acinetobacter baumanii-calcoaceticus* complex (ACBC).
METHODS: MICs for both strains of ACBC were determined by microbroth dilution. Antibiotic plates at 4 times the MIC were used to test for the presence of colistin resistant sub-populations with an inoculum of 1.5 x 10^8 cfu/ml. Time kill assays were performed with colistin at 0.25, 1, 4 and 16x the MIC against each isolate. Antibiotic carry-over was eliminated by centrifugation and re-suspension of the organism pellet in drug-free saline. Samples for colony counts were obtained over 24 hours. Samples were inoculated onto tryptic soy agar using a spiral plater and evaluated for colony counts after 18 hours of incubation.
RESULTS: The MIC/MBCs of colistin were 0.5 µg/ml against both isolates. No resistant sub-populations were detected. Rate of killing was similar for the 1, 4 and 16x the MIC. However, the rate of killing for those three simulations was significantly superior to the 0.25 x ($p<0.01$). With respect to extent of killing as measured by area under the bactericidal curve, 16x > 4x > 1x ~ 0.25 x MIC.
CONCLUSIONS: In contrast to the concentration dependent killing of colistin against Pseudomonas, colistin did not exhibit concentration dependent killing against MDR-ACBC.

87. Activity of colistin alone and in combination with ampicillin/sulbactam, ciprofloxacin and imipenem against multi-drug resistant *Acinetobacter baumanii-calcoaceticus* complex. *Sandy J. Close, Pharm.D.*, Steven J. Martin, Pharm.D., BCPS, Diane M. Cappelletty, Pharm.D.; University of Toledo, Toledo, OH.

PURPOSE: Nosocomial infections caused by multi-drug resistant (MDR) A*cinetobacter baumanii-calcoaceticus* (ACBC) are increasing, providing clinicians with significant therapeutic challenges. Monotherapy may not provide a positive clinical outcome; therefore combination therapies may be required. This study evaluated the synergistic activity of colistin (CS) with other antibacterials against MDR-ACBC.
METHODS: MICs for both strains of ACBC were determined by microbroth dilution. Time kill (TK) assays were performed against each isolate alone and in combination at each of the following concentrations: CS at 0.125x MIC, ampicillin/sulbactam (AS) and imipenem (I) at .25x MIC, and ciprofloxacin (C) at 4 µg/ml. Samples for colony counts were obtained over 24 hours. Samples were inoculated onto tryptic soy agar using a spiral plater and evaluated for colony counts after 18 hours of incubation.
RESULTS: The MICs against both isolates were: CS 0.5/0.5, AS 4/4, C 64/128, I 12/12 µg/ml. TK results for AS, C and I alone were similar to growth control. CS alone produced and sustained > 3-log reduction in cfu/ml. AS or C in combination with CS were no different than CS alone with respect to rate and extent of killing. I in combination with CS provided significantly more rapid killing ($p<0.02$) compared to CS alone. Due to the > 3-log reduction by CS alone, synergy could not be evaluated for any of the combinations.
CONCLUSIONS: CS exhibited significant activity against MDR ACBC alone impeding the ability to determine synergistic activity in combination. Further studies using colistin methanesulfonate (iv formulation), and an in vitro pharmacodynamic model will provide more detailed information.

88. Comparison of piperacillin/tazobactam monotherapy versus combination use in febrile neutropenic patients. *Jennifer L. Shamp, Pharm.D.*, Robert M. McNulty, Pharm.D., Debra A. Goff, Pharm.D., Sondra J. Sierawski, R.Ph.; Ohio State University Medical Center, Columbus, OH.

PURPOSE: To compare patient outcomes with piperacillin/tazobactam (P/T) monotherapy versus P/T combination in the treatment of patients with febrile neutropenia (FN), and subsequently develop a practice guideline.
METHODS: A prospective analysis of hospitalized adult patients receiving P/T for FN was conducted over 9 months. Treatment groups included P/T monotherapy, P/T + other gram-negative antibiotic (double), P/T + other gram-negative antibiotic + vancomycin (triple), or P/T + vancomycin. Clinical and microbiologic outcomes were compared. $p \leq 0.05$ was considered statistically significant.
RESULTS: Fifty-nine patients with FN received P/T, at a mean dose of 4.5 grams every 8 hours. The mean ANC at initiation of P/T was 212 neutrophils/mm^3. Among bacteremic patients (29%), 10 had S*taphylococcal spp*., 2 *P. aeruginosa*, 2 *E. coli*, 1 *Klebsiella spp*., and 2 other. Mortality was 1.7%. No significant differences were observed between the 4 P/T groups in clinical or microbiologic outcomes. Double and triple regimens often included an aminoglycoside with no additional clinical or microbiologic benefit.

	Monotherapy n=29	Double n=18	Triple n=4	P/T + Vancomycin n=8
Leukemia (#)	11	3	2	4
Hodgkins/BMT (#)	6	6	1	3
Solid tumor (#)	8	6	1	0
Other (#)	4	3	0	1
MASCC score	20	17.8	15.8	19.6
Antibiotic (days)	8.8	8.6	4	7
Time (hours) to afebrile	60	60	62	45
Treatment modification (%)	55	72	50	63
Treatment failure (%)	14	33	25	13
ADR (%)	41	28	25	38

CONCLUSIONS: P/T monotherapy was as effective as P/T combination therapy in patients with FN. Monotherapy is a viable alternative in the treatment of FN and is now included in our practice guideline.

89. Analysis of the impact of the piperacillin/tazobactam shortage on antibiotic expenditures and patient outcomes. *Kelli L. Davis, Pharm.D.*, John A. Bosso, Pharm.D.; Medical University of South Carolina, Charleston, SC.

PURPOSE: During the piperacillin/tazobactam (P/T) shortage of 2002, alternative antibiotics were recommended and utilized. Our purpose was to identify which antibiotics were used instead, and the effect of this substitution on antibiotic expenditures and patient outcomes.
METHODS: The study was conducted at a 600-bed tertiary care, teaching institution. To assess the effects of the P/T shortage, P/T and alternative antibiotic use for those indications for which P/T is used was quantitated (as defined daily doses normalized for hospital census: DDD) over the period of the shortage (3/1/02-8/30/02). Cost was determined based upon actual purchase prices. For the same time period, numbers of patients with diagnoses relating to potential P/T use, as well as their in-house mortality and length of stay (LOS) were also quantified. Antibiotic use, cost, and patient outcomes were compared to the same time period in 2001. Antibiotics considered to be alternatives to P/T, either alone or in combination, were ampicillin/sulbactam, ticarcillin/clavulanate (T/C), cefepime, cefotaxime, cefotetan, ceftriaxone, clindamycin, ciprofloxacin, imipenem, and metronidazole.
RESULTS: The shortage of P/T during 2002 was for the most part accommodated by increased use of cefepime (146% increase), T/C and antibiotics with anti-anaerobic activity. Number of cases and in-house morbidity for targeted DRGs were largely unchanged over the two comparative time periods ($p>0.05$). However, cumulative LOS decreased by 1.7 days and while DDDs increased 4.9%, total antibiotic expenditures for P/T and its alternatives decreased by 11.7% during the shortage.
CONCLUSIONS: Patient outcomes were not adversely affected during the P/T shortage of 2002 and use of alternative agents were associated with LOS and cost reductions for the institution.

90. Assessment of *Pseudomonas aeruginosa* resistance to cefepime and ceftazidime in a community/teaching hospital. *William L. Greene, Pharm.D.*; Methodist Healthcare-University Hospital, Memphis, TN.

PURPOSE: A formulary change from ceftazidime to cefepime was made at Methodist Healthcare in 2001. Compilation of data for construction of the antibiogram for 2002 revealed that 65% of *Pseudomonas aeruginosa* isolates were susceptible to cefepime, while 78% were susceptible to ceftazidime. This study was performed to determine whether this difference was due to true differences in susceptibility, or due to methodological differences.
METHODS: Consecutive clinical isolates of *Pseudomonas aeruginosa* (n=39) were tested for resistance to cefepime and ceftazidime by automated testing (Baxter Microscan™). Each isolate was also tested for resistance by Kirby-Bauer disc diffusion testing (K-B). Duplicates were eliminated. Definitions for susceptible, intermediate, and resistant were those defined by the National Committee for Certification of Laboratory Standards. Testing results were considered "concordant" when the same result was found for both tested parameters (e.g. cefepime susceptible and ceftazidime susceptible).
RESULTS:

Drug	%S/I/R (Microscan)	%S/I/R (K-B)	%Concordant
Cefepime	77/15/8	94/2/0	
Ceftazidime	82/5/13	94/3/3	
Cefepime vs ceftazidime (concordance)			84.6%
Microscan vs Kirby-Bauer			
Concordance, Cefepime	84.6%		
Concordance, Ceftazidime	79.4%		

CONCLUSIONS: Testing the activity of cefepime and ceftazidime against isolates of *Pseudomonas aeruginosa* results in appreciable discordance when comparing automated testing by Microscan with Kirby-Bauer disc diffusion. These results may have clinical significance.

91E. Community fluoroquinolone use and its relationship to hospital rates of ciprofloxacin-resistant *Pseudomonas aeruginosa*: a SCOPE-MMIT report.

Christopher K. Johnson, Pharm.D., Heather Tomes, Ronald E. Polk, Pharm.D.; Virginia Commonwealth University, Richmond, VA.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

92E. Association between fluoroquinolone use and prevalence of methicillin-resistant *Staphylococcus aureus* in U.S. hospitals: a SCOPE-MMIT report. Christopher K. Johnson, Pharm.D., *Ronald E. Polk, Pharm. D.*, Mike Edmond, M.D, Richard Wenzel, M.D.; Virginia Commonwealth University, Richmond, VA.

Presented at 40th Annual Meeting of the Infectious Diseases Society of America, Chicago, IL, October 24-27, 2002.

Nephrology

93. Itraconazole inhibits P-glycoprotein-mediated renal tubular secretion of cimetidine in humans. Chetan S. Karyekar, M.D., Ph.D., Andrew E. Briglia, D.O., Paul O. Gubbins, Pharm.D., FCCP, Natalie D. Eddington, Ph.D., *Thomas C. Dowling, Pharm.D., Ph.D.*; University of Maryland, Baltimore, MD.

PURPOSE: P-glycoprotein (PGP) may play an important role in the renal tubular secretion of endogenous substances, drugs and metabolites. The aim of this study was to evaluate the effect of itraconazole (ITZ, PGP inhibitor) on the renal handling of cimetidine (CIM, PGP substrate) in humans.
METHODS: Eight healthy volunteers received simultaneous 4-hour infusions of iothalamate (IOT) and CIM on study days 1 and 5. ITZ (400 mg/day) was administered on days 2 through 5. Plasma and urine concentrations of IOT, CIM, ITZ were determined using HPLC/UV. Glomerular filtration rate (GFR) was measured by IOT renal clearance (CL_{FILT}). Renal tubular secretion (CL_{TS}) of CIM was calculated as renal clearance (CL_R) minus CL_{FILT}. Estimates for total clearance (CL_T), volume of distribution (Vd), and steady-state plasma concentration (Cp_{SS}) were obtained using WinNonlin.
RESULTS: Plasma ITZ concentrations ranged from 0.41 to 0.92 µg/ml. The pharmacokinetic parameters for CIM on days 1 and 5 are shown below (reported as mean (SD)):

	Day 1	Day 5	p value
GFR (ml/minutes)	130 (25)	125 (24)	NS
Vd (L/kg)	1.28 (0.31)	1.16 (0.26)	0.04
CL_T (ml/minutes)	665 (41)	495 (34)	< 0.001
CL_{TS} (ml/minutes)	410 (93)	311 (89)	< 0.001
Cp_{SS} (mg/L)	709 (90)	837 (111)	< 0.01

CONCLUSIONS: The renal tubular secretion of CIM was significantly reduced following ITZ dosing resulting in increased systemic drug exposure. Plasma ITZ concentrations were similar to those reported to inhibit PGP in vitro. Further evaluation of drugs such as ITZ that alter the renal handling of PGP substrates is warranted.

94. Thiazolidinedione use and weight in hemodialysis patients. *John V. St. Peter, Pharm.D, BCPS*, Matthew J. Lewis, Pharm.D., BCPS, Leah J. Rein, Pharm.D., Jay L. Xue, DVM, Ph.D., Mehmood A. Khan, M.D.; Hennepin County Medical Center, Minneapolis, MN; University of Minnesota, Minneapolis, MN; Mayo Clinic, Rochester, MN.

PURPOSE: The mechanisms of thiazolidinedione (TZD) related edema and weight gain are currently unclear. If TZD-related edema and weight gain are mediated via the kidney, these effects may not be exaggerated or detectable in functionally anephric end-stage renal disease (ESRD) hemodialysis patients. This analysis characterizes weight fluctuation related to fluid accumulation between and removal during repeated hemodialysis sessions in a cohort of ESRD patients before and after TZD exposure.
METHODS: Retrospective analysis employing electronic medical records. Patients were eligible if they received TZD therapy while on hemodialysis, had baseline data prior to TZD use, and remained on the same TZD dose for at least two months. Total body weights were recorded before (Pre-HD) and after (Post-HD) each of 12 dialysis sessions during the month prior to TZD therapy and during the second month of TZD therapy. Summary statistics, regression analysis, ANOVA and Paired t-test were performed as appropriate.
RESULTS: Sixty patients (39 F, 21 M) met data criteria for analysis. Various TZD agents were used (troglitazone n=19, rosiglitazone n=29, pioglitazone n=12). No difference was detected in Pre-HD or Post-HD weight according to TZD use. However, when weights were normalized to the first weight of each assessment period, an increasing trend for weight removed during hemodialysis was detected (p=0.048).
CONCLUSIONS: The increasing trend for greater weight removed during HD with TZD therapy suggests that excess fluid accumulation may be occurring in these patients. However, other confounding factors such as changing dialysis prescription, dose and duration of therapy require further investigation.

95E. Safety of iron sucrose injection administered by rapid IV push in predialysis chronic kidney disease patients. C. Charytan, M.D., W. Quinibi, M.D., H. Singh, M.D., *M. H. Schwenk, Pharm.D.*, G. Aronoff, M.D., A. Besarab, M.D.; NY Hospital Medical Center of Queens, Flushing, NY; University of Texas Health Science Center, San Antonio, TX; Western Nephrology, Lakewood, CO; University of Louisville Hospital, Louisville KY; Henry Ford Hospital, Detroit, MI.

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96. A comparison of bleeding complications associated with enoxaparin versus unfractionated heparin in patients with renal insufficiency. *Anthony T. Gerlach, Pharm.D.*, Sondra J. Sierawski, R.Ph., Debra A. Goff, Pharm.D.; Ohio State University Medical Center, Columbus, OH.

PURPOSE: Enoxaparin (E) is associated with increased bleeding in patients with renal insufficiency (RI) versus normal kidney function. The purpose is to compare bleeding complications in those with RI receiving E or unfractionated heparin (UFH) for deep vein thrombosis (DVT) prophylaxis.
METHODS: Patients with RI (SCr > 2.0 mg/dl) who received E or UFH for DVT prophylaxis were retrospectively identified. Patients were matched for gender and age (± 10 years). A database was developed for demographics, length of stay, ICU stay, surgery, concomitant drugs (antiplatelets, glycoprotein IIb/IIIa inhibitors, thrombolytics, NSAIDS and warfarin), and blood products. Bleeding was defined as transfusion of two or more units of packed red blood cells (PRBC) while on E or UFH and at least 48 hours after surgery. Statistical analysis was performed by chi-squared and independent T-tests.
RESULTS: One-hundred ten patients (34 female) were evaluated, and 29 received PRBC. There was no statistical difference in length of stay, ICU stay, surgery or bleeding between groups. Forty-nine patients received concomitant medications that increase bleeding risk including 31 on aspirin.

	Enoxaparin n=55	UFH n=55	p value
Mean age	61.2 years	63.6 years	0.375
Mean Length of stay	42 days	46 days	0.223
ICU Stay	17	16	0.835
Surgery	29	28	0.849
Concomitant drugs	19	30	0.035*
Aspirin	8	23	0.0015*
Bleed	13	16	0.516

*Statistically significant

CONCLUSIONS: Use of E for DVT prophylaxis does not appear to cause increased bleeding over UFH in those with renal insufficiency. Prospective studies are needed to assess bleeding.

97. Following the International Society for Peritoneal Dialysis (ISPD) guidelines for peritoneal dialysis-related peritonitis: are they adequate? *Sarah E. Woodworth, B.Sc.Pharm.*, Lori D. Wazny, Pharm.D., Janet E. Martin, Pharm.D.; London Health Sciences Center, London, ON, Canada.

PURPOSE: In January 2001, our peritoneal dialysis (PD) program adopted the ISPD consensus recommendations to use intraperitoneal (IP) cefazolin plus IP ceftazidime (C-C) instead of vancomycin-tobramycin (V-T) for empiric therapy of PD-related peritonitis. This study was conducted to evaluate the causative microorganisms and analyze antibiotic sensitivity patterns to determine the adequacy of C-C at our institution.
METHODS: Records of all PD-related peritonitis episodes occurring during January 15, 2001 to January 15, 2002 were reviewed. Results of microbiological cultures, antibiotic sensitivities and clinical course were recorded.
RESULTS: A total of 67 episodes of culture-positive peritonitis occurred in 46 PD patients during the study period. Gram-positive, gram-negative, mixed, and fungal infections accounted for 50.7%, 38.8%, 4.5%, and 6.0% of total peritonitis episodes, respectively. *Staphylococcus epidermidis* was the most common organism isolated (26.9%). *Klebsiella* species (11.5%) and *Pseudomonas aeruginosa* (7.7%) were the most common causes of gram-negative peritonitis. Cefazolin provided adequate coverage for 70.8% of coagulase-negative *staphylococcus* and 83.3% of *Staphylococcus aureus* isolates. However, 4 out of 6 episodes of methicillin resistant *S. epidermidis* were successfully treated with cefazolin. All *Klebsiella* species, *P. aeruginosa*, and *Escherichia coli* isolates were susceptible to ceftazidime. Clinical failures were higher in gram-negative peritonitis than in gram-positive peritonitis (57.7% vs 14.7%, p<0.001).
In vitro, empiric C-C compared with V-T resulted in significantly less coverage (66.7% vs 81.8%, p<0.001) of all peritonitis episodes. Also, the clinical success rate of C-C was significantly inferior to V-T (75.8% vs 81.8%, p<0.001).
CONCLUSIONS: While the ISPD recommended empiric treatment protocol provides adequate coverage for the most common microorganisms causing PD-related peritonitis at our institution, the coverage rates with C-C were significantly inferior to that of V-T.

98E. Use of an in vitro method to determine drug removal during renal replacement therapies. *Joanna Q. Hudson, Pharm.D.*, Roya M. Sameri, Pharm.D., Adnan Naseer, M.D., William R. Bastnagel, M.D.; University of

Tennessee, Memphis, TN.

Published in J Am Soc Nephrol 2002;13:417A.

Neurology

99. Readability of stroke information for patients: an educational dilemma. *Dana M. Nighswander B.S.,* Denise H. Rhoney, Pharm.D.; Wayne State University, Detroit, MI.

PURPOSE: Stroke is the 3rd leading cause of death in the United States and yet through adequate patient education, is preventable. Written information is a valuable method of education and recommendations state that written information for adults be no greater than a fifth grade level; although patient information for other disease states are higher than this level. This study evaluated the readability of patient information available to stroke survivors and their families/caregivers.
METHODS: Patient information was obtained from multiple sources, yielding 130 samples. The information was classified according to source, content, intended audience, type of stroke (ischemic or hemorrhagic), and origin of information (Internet or pre-printed). Readability was assessed using the Flesch Reading Ease Score (FRES) and Flesch-Kincaid Grade Level (FKGL).
RESULTS: The mean FKGL and FRES for all 130 samples was 9.9 and 48.8 respectively. Only source and origin of information were significant for FRES and FKGL. Mean FKGL and FRES scores for the different sources were: national stroke associations, 8.5, 55.2 (pre-printed); 11.0, 40.8 (Internet); pharmaceutical manufacturers 9.5, 53.1 (pre-printed); 10.3, 46.6 (Internet); government/university/professional organization, 10.4, 42.4; Micromedex/ USPDI, 8.6, 60.3; general Internet, 10.9, 42.1; lay press, 11.3, 44.2, hospital/clinic 7.7, 60.5. Internet samples had a significantly higher FKGL (10.8 vs 8.7, $p<0.0001$) and lower FRES (43.0 vs 55.1, $p<0.0001$) than pre-printed information.
CONCLUSIONS: The majority of the information sampled was written at levels higher than a fifth grade reading level, particularly the information obtained from the Internet. Stroke is a highly preventable condition and therefore efforts are needed to improve available patient information to be suitable for persons with lower literacy levels.

Nutrition

100E. The effect of a hypocaloric parenteral nutrition on the incidence of hyperglycemia and insulin requirements in surgical patients. Christine L. Ahrens, Pharm.D., Jeffrey F. Barletta, Pharm.D., Salmaan Kanji, Pharm.D., James G. Tyburski, M.D., Robert F. Wilson, M.D., Sylvia Simmons, R.D., *John W. Devlin, Pharm.D.*; Detroit Receiving Hospital, Detroit, MI.

Presented at the 2003 Congress of the Society of Critical Care Medicine, San Antonio, TX, January 2003.

101. Erythrocyte total glutathione levels in LBW infants receiving cysteine supplemented parenteral nutrition. Michael C. Storm, Ph.D., *Richard A. Helms, Pharm.D.*; University of Tennessee Health Science Center, Memphis, TN.

PURPOSE: RBC glutathione (GSH) levels are low in LBW premature infants who require parenteral nutrition (PN). Cysteine (CysH) may be the limiting amino acid (AA) in GSH biosynthesis. We evaluated RBC GSH levels in LBW premature infants receiving PN with varying CysH doses.
METHODS: Eighteen infants were randomized. PN dosage was 2.5 gAA/kg/day and carbohydrate and fat at 125 kcal/kg/d. Infants received no supplemented CysH for three days. Infants then received one of six randomly assigned CysH schedules. Each CysH dose (10, 20, and 40) was administered for three days. Blood was drawn on the morning of the last day in each dosing interval (days 3, 6, 9, and 12). Whole plasma, deproteinized plasma and washed RBC were prepared immediately. Plasma AA were determined on a Beckman 6300 analyzer. Total cysteine/cystine was determined by a modified Gaitonde method and GSH in RBC by a modified Tietze method.
RESULTS: Plasma free cystine, total cysteine/cystine, and taurine increased with CysH dosage. Plasma glutamic acid and glycine (normal) and glutamine levels (low normal) did not vary. GSH was low initially and highly variable. GSH data were normalized to the initial (0 dose) value. Compared to zero CysH, the RBC GSH levels at 10, 20, and 40 dosages were 145% ($p=0.051$), 139% ($p=0.031$), and 174% ($p=0.003$) respectively.
CONCLUSIONS: RBC levels of GSH are variable and increase with CysH dosage. This data suggests that CysH is the rate limiting AA in GSH synthesis.

Oncology

102. Pegfilgrastim is eliminated primarily by neutrophil-mediated clearance with minimal renal clearance. *Bing-Bing Yang, Ph.D.,* Eve Carithers, M.S., Cynthia Mayer, M.S., Luis Meza, M.D.; Amgen Inc., Thousand Oaks, CA; Southwest Oncology Associates, Lafayette, LA.

INTRODUCTION: Pegfilgrastim (Neulasta™) is produced by covalently binding a 20-kd polyethylene glycol molecule to the Filgrastim (NEUPOGEN®) N-terminus. Pegylation of Filgrastim diminished renal clearance as demonstrated in a rat study. Mean (SD) clearance of pegfilgrastim was similar for bilaterally-nephrectomized (9.2 [2.7] ml/hour/kg) and sham-operated (11.4 [1.8] ml/hour/kg) rats, while clearance of Filgrastim was significantly decreased in nephrectomized rats (17.2 [1.7] ml/hour/kg) compared with sham-operated rats (45.1 [2.4] ml/hour/kg).
METHODS: In a pivotal, double-blind trial, breast cancer patients received doxorubicin/docetaxel every 21 days for 4 cycles and either once-per-cycle pegfilgrastim 100 µg/kg (n=154) or daily Filgrastim 5 µg/kg (n=156). Serum samples for pegfilgrastim and Filgrastim concentration measurement by ELISA were collected in each cycle on day 7 (day of expected absolute neutrophil count [ANC] nadir) to explore relationships between drug levels and either creatinine clearance or ANC levels.
RESULTS: Pegfilgrastim was as safe and effective in reducing the duration of severe neutropenia (DSN) as Filgrastim (Holmes, 2002). Filgrastim concentration appeared to increase with decreasing creatinine clearance ($r_{Pearsons}$=-0.19), indicating Filgrastim is cleared by the kidney during neutropenia. Pegfilgrastim concentration was not significantly correlated ($r_{Pearsons}$=0.05) with creatinine clearance, and appeared to be higher in subjects with lower ANC nadir and longer DSN. The median pegfilgrastim concentration was higher in cycle 1 than later cycles (cycle 1: 40.95 ng/ml vs cycle 4: 16.27 ng/ml), consistent with increasing drug clearance possibly resulting from neutrophil and neutrophil precursor expansion in later cycles.
CONCLUSIONS: Pegfilgrastim clearance appears to be neutrophil-mediated with minimal involvement by the kidney.

103E. Phase I study of liposome encapsulated mitoxantrone in patients with advanced cancers. *Mayer Fishman,* Lewis Strauss, Patricia LoRusso, Eric Kraut, Przemyslaw Twardowski, Christina Fleming, Jeffrey Sherman, Allen Zhang, Sumsullah Khan, Usha Kasid; H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL; University of South Florida, Tampa, FL; NeoPharm, Inc., Lake Forest, IL; Karmanos Cancer Center, Detroit, MI; Ohio State Cancer Center, Columbus, OH; City of Hope National Cancer Center, Duarte, CA; Georgetown University Medical Center, Washington, DC.

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104. Time to first febrile neutropenia among early stage breast cancer patients receiving adjuvant chemotherapy. *Shane D. Scott, Pharm.D.,* Elizabeth A Chrischilles, Ph.D., Brian K. Link, M.D., David J. Delgado, Ph.D., Moshe Fridman, Ph.D., Gary H. Lyman, M.D.; University of Iowa, Iowa City, IA; Amgen, Inc., Thousand Oaks, CA; AMF Consulting, Inc., Los Angeles, CA; University of Rochester, Rochester, NY.

PURPOSE: To describe factors associated with the timing of febrile neutropenia (FN) during adjuvant breast cancer chemotherapy (CAF, AC, CMF).
METHODS: A historical case series of 887 ESBC patients who received initial chemotherapy from 14 community and academic oncology practice settings participating in the Oncology Practice Pattern Study between 1991-1999 was reviewed. Patients did not receive primary prophylaxis with CSF. A total of 90 (10%) patients experienced FN (i.e., temperature of > 100.6°F and ANC < $1000/mm^3$). The time to first FN was estimated by the Kaplan-Meier method. The significance of risk factors was evaluated with the log-rank test and proportional hazards regression analysis.
RESULTS: A total of 72% (635/887) of the patients received adriamycin-containing therapy. Sixty percent (54/90) of first FN occurred during the first two cycles of therapy. A total of 68% (61/90) of the patients that had FN also had a FN hospitalization (FNH); and 57% (35/61) of the FNH happened in the first 2 cycles of chemotherapy. A total of 31% (28/90) of first FN occurred by day 15 of cycle 1. The time (days) to first FN was shorter among patients receiving adriamycin-containing therapy, patients with renal disease, and patients with smaller body surface (BSA) (log-rank test $p<0.05$). Stepwise proportional hazards regression analysis demonstrated that the time to first FN was significantly associated with: adriamycin-containing therapy, (HR=1.8; 1:1-3.0), renal disease (HR=6.7; 1.7-27.4), and BSA < $1.75m^2$ (HR=1.9; 1.2-3.0).
CONCLUSIONS: The majority of FN occurred within the first two cycles of therapy and FN increases with adriamycin, renal disease and smaller BSA.

105. Same day dosing of pegfilgrastim in patients receiving fractionated dose chemotherapy. *Larry Y. Watt, Pharm.D., MBA,* Robert Levin, M.D., Robert E. Musick, R.Ph.; Midwestern Regional Medical Center, Zion, IL.

Pegfilgrastim (PG) has the potential to simplify the management of chemo-induced neutropenia. One limitation remains that data on concomitant use with chemotherapy are lacking. For this reason, PG should be administered after 24 hours following chemotherapy. Adhering to this schedule may pose a logistic challenge for outpatients. Patients receive fractionated dose chemotherapy at our institution; some receive PG on the last day of

chemotherapy (i.e. same day dosing or SDD).
PURPOSE/METHODS: To assess the efficacy and safety of SDD of PG through a retrospective chart review. Patients received filgrastim (G) initiated the next day after chemotherapy served as controls.
RESULTS: Data from 104 patients-a total of 199 chemotherapy cycles-were included in the analysis; 60 received PG for 99 cycles (M/F=24/36, mean age=55 years) and 44 received G for 100 cycles (M/F=13/31, mean age=54 years). The mean pre-chemo ANCs were 5350 ± 2500 cells/mm^3 for the study arm and 4940 ± 2590 cells/mm^3 for the control arm, respectively (p=0.48). The mean ANC nadirs for PG and G were 3040 ±1740 cells/mm^3 and 2640 ± 1330 cells/mm^3, respectively (p=0.20). The rates of grades III-IV neutropenia were comparable for PG (18%: III=6; IV=12) and G (14%: III=9; IV=5) (p=0.15). There were no significant differences in the number of patients that had adverse outcomes (e.g. unplanned MD/ER visits ± hospitalization due to neutropenia) or in the number of cycles resulting in an adverse outcome between groups.
CONCLUSIONS: SDD of PG appeared effective and was not associated with increased incidence of negative outcomes in the study population.

106. Identification and analysis of single nucleotide polymorphisms in the gemcitabine metabolic pathway. *Anna K. Fukunaga, M.S.*, Sharon Marsh, Ph.D., Daryl J. Murry, Pharm.D., Howard L. McLeod , Pharm.D.; Purdue University, Lafayette, IN; Washington University, St. Louis, MO.

PURPOSE: To identify and validate single nucleotide polymorphisms (SNP) in the genes involved in 2′-2′-difluorodeoxycytidine (dFdC, gemcitabine) metabolism.
METHODS: Blood samples were obtained from healthy Ghanaian and American Caucasian volunteers. The metabolic enzymes investigated in this study are cytidine deaminase (CDA), SLC28A1 (solute carrier family 28, member 1), SLC28A2 (solute carrier family 28, member 2), SLC29A1 (solute carrier family 29, member 1), deoxycytidine kinase (DCK), POLA2 (DNA polymerase α 2) and deoxycytidine monophosphate deaminase (DCTD). Polymerase chain reaction (PCR) technique was employed to amplify the genes in the gemcitabine metabolic pathway. Pyrosequencing was utilized to obtain the SNP allele frequencies.
RESULTS: Seven of the 12 SNPs analyzed have allele frequencies that were found to be significantly different between American Caucasian and Ghanaian populations, p<0.05. The SNPs validated are CDA 208 G > A, CDA 79 A > C, DCK 2190 A > T, DCTD 315 T > C, SLC28A1 1543 G > A, SLC28A1 1576 T > C and SLC28A2 283 A > C.
CONCLUSIONS: Several SNPs in the gemcitabine metabolic pathway have been validated in this investigation. Further functional assays of these SNPs should be performed to optimize gemcitabine therapy.

107. Determinants of CPT-11 and SN-38 cytotoxicity in colon carcinoma cell lines. *Sara K. Quinney, Pharm.D.*, Daryl J. Murry, Pharm.D., Sonal P. Sanghani, Ph.D., William F. Bosron, Ph.D.; Purdue University; Indiana University, Indianapolis, IN.

PURPOSE: Irinotecan (CPT-11), indicated for the treatment of metastatic colon cancer, is converted by carboxylesterases to the more active topoisomerase inhibitor SN-38. We examined the activity of human carboxylesterases (CES1, CES2, CES3) and topoisomerase I (TOPOI), and the cytotoxicity of CPT-11 and SN-38 in human colon carcinoma cell lines.
METHODS: DLD-1, HCT-15, and HT-29 cell lines were used. Carboxylesterase activity was evaluated using a spectrophotometric assay that followed conversion of 4-methylumbelliferyl acetate (4-MUA) to 4-methylumbelliferone. Non-denaturing polyacrylamide gel electrophoresis and subsequent gel incubation with 4-MUA allowed determination of CES1 and CES2 activity. TOPOI activity in nuclear extracts was determined as the amount of protein required to fully relax 0.1 µg of supercoiled pHOT1 DNA (TopoGen Inc.). CPT-11 hydrolase activity was assessed by incubating cell extracts with 50 micromol CPT-11 for 24 hours at 37ºC and the product SN-38 quantified using HPLC. Cell viability after 72-hour incubations with varying concentrations of CPT-11 or SN-38 was assessed using a MTS assay (Promega).
RESULTS: TOPOI activity was greater in DLD-1 cells than in the other lines (p<0.05). All cell lines exhibited higher CES2 activity than CES1 activity.

Cell Line	CPT-11 IC_{50} (micromol)*	SN-38 IC_{50} (micromol)*	Carboxylesterase Activity by 4-MUA (micromoles/mg/hour)	CPT-11 Hydrolase Activity (pmole/mg/hour)	TOPOI Activity (U/mg)
DLD-1	49.7 + 13.5	0.363 + 0.138	0.064	57.5	2174
HCT-15	27.2 + 16.3	0.054 + 0.012	0.123	55.7	400
HT-29	23.1 + 6.0	0.083 + 0.068	0.034	148.7	370

*Mean + SD

CONCLUSIONS: Cell lines with greater TOPOI activity and lower carboxylesterase activity are more resistant to CPT-11. SN-38 exhibits greater cytotoxicity in cells with lower TOPOI activity.

Pediatrics

108. Factors affected predictability of serum theophylline level in preterm infants. *Ching-Lan Cheng, M.S.*, Chen-Hsi Chou, Ph.D., Chia-Yin Lin, M.S., Chyi-Her Lin, M.D.; National Cheng Kung University; National Cheng Kung University Hospital, Tainan, Taiwan.

PURPOSE: This study was to investigate the pharmacokinetic parameters, clearance rate of preterm infants treated with theophylline for apnea and factors contributed to poor predictability of its serum levels.
METHODS: Estimated pharmacokinetic parameters by the population pharmacokinetics model. Data of all patients received theophylline and had serum concentration checked at least once were reviewed retrospectively. The data included: gestational age, postnatal age, gender, birth history, maternal history, medical history, theophylline serum concentrations and body weight changes.
RESULTS: There were 429 theophylline values from 92 preterm infants. Mean ± SD gestational age and birth weight were 28.6 ± 2.7 weeks and 1244 ± 0.48 g, respectively. The clearance rate was 0.0309 ± 0.012 L/hour (0.0095 ~ 0.0929 L/hour), there was a nonlinear correlation between dose and serum concentration (Pearson CC: 0.24, r^2=0.0471, p<0.0001), linear correlation between post-conceptional age and clearance (r^2=0.74, p<0.0001). Discrepancy between the estimated and measured theophylline serum concentration greater than 10 µg/ml was observed in three premature infants; all had lost more than 24% of body weight within 1 week of life, birth weight less than 1000 g, two had dosing interval of every eight hours, and change of dose one day before blood sampling.
CONCLUSIONS: Preterm infants have wide range of clearance of theophylline. Post-conceptional age is a maturational marker and associated with theophylline clearance. Birth weight less than 1,000 g, greater body weight change and changing dosage before sampling were the factors contributed to the large discrepancy between the estimated and measured theophylline concentrations.

109. Comparison of oral chloral hydrate and midazolam for sedation in children undergoing EEG, CT and MR imaging. Devanshi Patel, Pharm.D., *Gladys El-Chaar, Pharm.D.*, Craig Merola, M.D., Robert Katz, M.D.; St. John's University, Jamaica, NY; Schneider Children's Hospital, New Hyde Park, NY

PURPOSE: This study was carried out to determine if midazolam may offer an equally efficacious and potentially safer alternative to chloral hydrate for pediatric patients prior to EEG, CT and MRI procedures.
METHODS: This prospective, randomized, blinded trial randomized children between 6 months and 16 years of age to receive either oral chloral hydrate 75 mg/kg (maximum dose 2 g) or oral midazolam (1.0 mg/kg for children 6 months to 6 years and 0.5 mg/kg for children 6-16 years, maximum dose 20 mg) if they met the inclusion criteria. The sedation scale used was obtained from the Institutions own Conscious Sedation Procedure Record. Primary outcomes measured: Differences in efficacy were determined by the procedure success rate, differences in onset of action and duration of action. We also recorded the type and frequency of adverse events.
RESULTS: Fourteen study participants were enrolled, 8 were randomized to receive chloral hydrate and 6 to receive midazolam. An interim analysis revealed significant differences in the procedure success rates between the 2 agents; 100% (8/8) with chloral hydrate versus 50% (3/6) for midazolam (p=0.024). The mean onset of action was 13.1 minutes for chloral hydrate versus 10.6 minutes for midazolam (p=0.52). The mean duration of action was 85 minutes for chloral hydrate versus 62.5 minutes for midazolam (p=0.57). No major adverse effects were reported in either group; one patient in the midazolam group experienced a paradoxical reaction.
CONCLUSIONS: midazolam used at the currently recommended doses, failed to serve as an alternative to chloral hydrate for pediatric sedation prior to CT scans and MRI's.

110. Randomized, double-blind, placebo-controlled trial of recombinant human erythropoietin administration to reduce red blood cell transfusions in anemic pediatric intensive care patients. *Michael F. Chicella, Pharm.D.*, Paul Jansen, M.D., Sheryl Falkos, M.D., Kem P. Krueger, Pharm.D., Ph.D.; Cincinnati Children's Hospital, Cincinnati, OH; University of South Alabama, Mobile, AL; Auburn University, Auburn, AL.

PURPOSE: 85% of patients in the intensive care unit receive ≥ 1 red blood cell (RBC) transfusions. Complications associated with RBC transfusions are rare, but significant. This study was preformed to determine if prophylactic recombinant human erythropoietin (rHuEPO) administration reduces the number of RBC transfusions anemic pediatric intensive care (PICU) patients receive.
METHODS: Patients were randomized to receive either intravenous rHuEPO 300 units/kg/day or placebo. Both groups received elemental iron 6 mg/kg/day. Number of RBC units transfused, final hematocrit (Hct), Hct change and reticulocyte count change from baseline were compared between the groups.
RESULTS: 27 patients, ages 1 month - 13 years were enrolled. Baseline Hct were 26.3 ± 1.6, and 25.7 ± 2.1 in the rHuEPO and placebo groups respectively (p=0.43). Baseline reticulocyte counts were 1.6 ± 0.9 and 1.4 ± 1 in the rHuEPO and placebo groups respectively (p=0.56). Baseline erythropoietin was 3.2 ± 1.4 in the rHuEPO, and 3.3 ± 1 in the placebo group

(p=0.84).

	rHuEPO (n=14)	Placebo (n=13)	p value
Total units transfused	3	8	0.58
% Hct change (baseline to final)	3.9 ± 4	1.2 ± 4.3	0.14
Final Hct	30.3 ± 3.6	26.8 ± 4.8	0.06
% Reticulocyte count change (baseline to final)	0.9 ± 0.9	0.2 ± 0.8	0.07

No difference was noted between the two groups in frequency of adverse events.
CONCLUSIONS: In this small group of anemic PICU patients, prophylactic rHuEPO administration did not reduce the number of RBC units transfused. Furthermore, it did not significantly increase Hct or reticulocyte count when compared to placebo.

111. Fungal infections in pediatric patients receiving parenteral nutrition. *Joseph D. Presley, Pharm.D.*, Catherine M. Crill, Pharm.D.; University of Tennessee Health Science Center; Le Bonheur Children's Medical Center, Memphis, TN.

PURPOSE: To evaluate the incidence and type of fungal infections and risk factors in a pediatric parenteral nutrition (PN) population.
METHODS: Computerized search of pharmacy records identified patients receiving PN and systemic antifungal therapy over a 12-month period. Retrospective review included patient demographics, culture results, PN, antibiotic and antifungal history, and risk factors.
RESULTS: Ninety-eight patients received antifungal therapy and 181 patients received PN over the 12-month period. Twenty-eight patients [(15 M/13 F; < 1 month of age (n=4), 1-12 months (n=16), > 1 year (n=8)] were on PN at the time of antifungal therapy. Excluding home PN patients (n=4; PN length of 3-42 months), PN duration prior to antifungal therapy was 23.1 ± 25.2 days (2-120). Of all positive cultures (n=32), *Candida albicans* was most prevalent [blood (n=9), urine (n=8), trachea (n=3), abdomen/wound (n=3)]. Other cultured species included *Candida parapsilosis* [blood (n=4)], *Candida glabrata* [blood (n=2)] and *Candida tropicalis* [blood (n=1), urine (n=1), trachea (n=1)]. Five patients had positive cultures from multiple sites, while 6 had no positive cultures. Antifungal therapy included amphotericin B (n=21; 12.3 ± 8.6 days), fluconazole (n=16; 6.8 ± 4.7 days), caspofungin (n=1; 18 days), and flucytosine (n=1; 19 days). Eight patients received multiple agents. All patients had central access, 25 (89%) were on broad-spectrum antibiotics, 15 (54%) were receiving steroids, and 15 (54%) had a history of GI surgery.
CONCLUSIONS: Approximately one-third of patients receiving antifungal therapy over the 12-month period were PN patients. In addition to PN, other risk factors include central lines, antibiotic and steroid use, and GI surgery.

Pharmacoeconomics

112. Prescription drug sample inventory and use at a multi-physician clinic. Shawn B. Andreasen, Pharm.D. candidate, Cara Lawless-Liday, Pharm.D., *Catherine A. Heyneman, Pharm.D., M.S.*, Brian Braegger, Pharm.D. candidate; Idaho State University, Pocatello, ID.

PURPOSE: A study was conducted to evaluate the extent and monetary impact of drug sample inventory and use at a multi-physician clinic.
METHODS: An initial inventory of prescription drug samples was conducted. The quantity and monetary value of drug samples on hand, samples entering and leaving the clinic, and average value of samples received by patients over one week were determined. After new samples were accounted for, a final inventory was conducted. All prices were based on AWP.
RESULTS: Drug samples worth $112,359 (excluding outdates) were on hand at the clinic; vouchers for rebates or free medication were worth an additional $12,810. Outdated medications valued at $10,131 were removed from inventory. Over a one-week period, drug company representatives brought samples worth $20,733 into the clinic. Samples (vouchers were not tracked) worth $20,833 were given to 157 of 439 patients seen (35.8%). Each patient who received samples left with pharmaceuticals worth an average of $133 (range $4.50 to $1,174).
CONCLUSIONS: Even in small, relatively rural clinics, drug samples made available for free distribution to patients constitute a substantial dollar amount. Prescription samples represent a significant economic investment by drug companies. While this practice obviously saves patients money in the short term, it remains to be seen if patients benefit economically over the long term. Large numbers of outdated samples were also found, indicating a need for improvement in outdate removal.

113. Pharmacoeconomic evaluation of tiotropium in COPD. *Daniel E. Hilleman, Pharm.D.*, Pamela A. Foral, Pharm.D.; Creighton University Medical School, Omaha, NE.

PURPOSE: Tiotropium (T) is a new long-acting anticholinergic agent indicated for the management of COPD. The purpose of the present study was to conduct a post-hoc economic analysis of two long-term trials of T in COPD.
METHODS: Two long-term (1 year) studies evaluated the impact of T on pulmonary function and health outcomes in COPD. The economic model used was a health-care resource utilization analysis from the health care payer perspective. Costs of drug therapy (WAC), plus the costs of exacerbations and hospitalizations were determined for the individual treatment groups. Sensitivity analysis where costs of drugs and events were adjusted by 20% was performed.
RESULTS: Study 1 compared T (n=550) with placebo (P) (n=371). FEV_1 was significantly improved compared to P. Exacerbations occurred in 36% of T patients and 42% of P patients. Hospitalizations for exacerbations occurred in 8.6% of T patients and 16.2% of P patients. Study 2 compared T (n=356) with ipratropium (I) (n=179). FEV_1 was significantly improved with T compared to I. Exacerbations occurred in 35% of T patients and 46% of I patients. Hospitalizations occurred in 7.3% of T patients and 11.7% of I patients. In study 1, T had annual per patient costs of $989 ($300 drugs; $198 exacerbations, $491 hospitalization) compared with $1145 ($231 exacerbations, $941 hospitalizations) for P. In study 2, T had annual per patient costs of $913 ($300 drugs, $193 exacerbations, $420 hospitalizations) compared to $1166 ($240 drugs, $252 exacerbations, $674 hospitalizations) for I. The results were not significantly altered by the sensitivity analysis.
CONCLUSIONS: T is cost-effective in the management of COPD primarily because it reduces the frequency of COPD exacerbations and hospitalizations compared to placebo or I.

114. Population-based, treat-to-target analysis of rosuvastatin in hypercholesterolemic patients. *Daniel E. Hilleman, Pharm.D.*, B. Daniel Lucas, Jr., Pharm.D.; Creighton University Medical School, Omaha, NE; CamCare Health, Education, and Research Institute, Charleston, WV.

PURPOSE: To conduct a population based treat-to-target pharmacoeconomic analysis of rosuvastatin (R) in hypercholesterolemic patients.
METHODS: We previously reported the cost-effectiveness of the 6 commercially available statins using theoretical treatment modelling. Atorvastatin (A) was the most cost-effective agent. In the present study, we compared A with R using a similar methodology. Baseline lipid profiles were collected from 5436 (2345 low-risk, 1318 moderate-risk, 1773 high-risk) hypercholesterolemic patients. Treat-to-target results were modeled using literature-derived LDL-C reductions. Cost of R was assumed to be identical to A (using 2002 WAC). Costs of clinic visits ($42) and lipid profiles ($27) were based on CPT coding. Costs were based on a one year follow-up.
RESULTS: R 10 mg achieved LDL-C goals in 100% of low- and moderate-risk patients. In high-risk patients, R 10 mg achieved the LDL-C goal in 96% of patients with 4% requiring R 20 mg. A total of 10,943 clinic visits and lipid profiles were required to achieve LDL-C goals with R. A 10 mg achieved LDL-C goals in 100% of low-risk patients. In moderate-risk patients, 95% achieved goal with A 10 mg and 5% required A 20 mg. In high-risk patients, 25% of patients achieved goal with A 10 mg, 63% with A 20 mg, 18% with A 40 mg, and 4% with A 80 mg. A total of 14,183 clinic visits and lipid profiles were required to achieve LDL-C goals with A. Acquisition costs with one year of R therapy was $3.75 million and $4.32 million with A. Lower acquisition costs with R compared to A was due to lower doses needed to achieve LDL-C goals. Clinic visits and lipid profile costs were $755,067 with R and $978,627 with A. Total cost was $4.50 million for R and $5.30 million with A. Per patient per year cost was $828 for R and $975 for A.
CONCLUSIONS: R was more cost-effective than A due primarily to a higher percentage of patients achieving LDL-C goals on lower doses of R than with A which required fewer titration visits and follow-up laboratory tests.

115. Mortality and length-of-stay among hospitalized community-acquired pneumonia floor patients treated with ceftriaxone, ceftriaxone plus a macrolide, or levofloxacin. *Christopher R. Frei, Pharm.D.*, Jim M. Koeller, M.S.; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: Current guidelines for the treatment of community-acquired pneumonia (CAP) recommend empiric antibiotic coverage for atypical pathogens. This study evaluates the need for atypical coverage by examining mortality and length of stay (LOS) among floor patients treated with 3 common antibiotic regimens.
METHODS: Medical records of CAP patients admitted between 1 January 1996 and 31 December 2001 from 176 U.S. community hospitals were reviewed. Patients' demographics, medical history, hospital course, antibiotic regimens, and discharge disposition were collected. Patients were divided into 1 of 3 mutually exclusive groups on the basis of antibiotics received: 1) ceftriaxone, 2) ceftriaxone plus a macrolide, or 3) levofloxacin. Mortality and LOS were evaluated in regression models while controlling for patient age, admit year, geographic region, pre-arrival setting, comorbid disease, and length of IV therapy.
RESULTS: We identified 2782 patients who received ceftriaxone (n=1068), ceftriaxone plus a macrolide (n=954), or levofloxacin (n=760). Groups differed with respect to age (age ± SD) (72 ± 16, 67 ± 18, and 69 ± 17 years, $p<0.0001$), admission from a nursing home (6.5%, 3.2%, and 1.6%, $p<0.0001$), and length of IV antibiotic therapy (days ± SD) (4.5 ± 2.7, 4.0 ±

2.6, and 3.6 ± 2.4 days, p<0.0001). Mortality confounders included: age, nursing home, heart failure, and cancer. LOS confounders included: age, admit year, region, heart failure, diabetes mellitus, cancer, and length of IV antibiotic therapy. After controlling for these confounders, no significant differences were noted for mortality (2.8%, 1.9%, and 2.4%, p=0.7884) or LOS (days ± SD) (5.5 ± 3.5, 4.8 ± 2.8, 4.7 ± 2.7 days, p=0.1666).
CONCLUSIONS: Empiric coverage for atypical pathogens does not appear to impact mortality or length of stay among CAP patients treated on the medical floor.

Pharmacoeconomics

116. Retrospective analysis of 1.2 million statin prescriptions to determine co-prescribing rates of drugs associated with increased risk of myopathy/rhabdomyolysis. *Patrick P. Gleason, Pharm.D., BCPS*, Dell B. Mather, Pharm.D., Robert J. Konop, Pharm.D., Timothy Brelje, M.S., Kyle Vance-Bryan, Pharm.D.; Prime Therapeutics, Inc., Eagan, MN.

PURPOSE: The joint clinical advisory on the use and safety of statins (JACC 2002;40:568-73) and the updated simvastatin package insert (PI) (May 2002) have heightened the awareness and summarized the evidence for potential drug-drug interactions with the statins. During the annual statin class review at a pharmacy benefit manager (PBM), an analysis of statin co-prescribing with drugs that may interact was performed. The primary comparison was between pravastatin (lower theoretical potential for drug-drug interactions due to the different metabolic pathway) and simvastatin (specific labeling regarding drug-drug interactions).
METHODS: Statin (atorvastatin, fluvastatin, lovastatin and lovastatin + niacin [Advicor], pravastatin, and simvastatin) prescriptions (Rx) during July 1, 2001 to June 30, 2002 were identified from a PBM claims database representing 4.5 million members. Use of oral drugs that should not be taken concomitantly with a statin were defined as those listed in the simvastatin PI as drugs to be avoided during simvastatin therapy (itraconazole, ketoconazole, erythromycin, clarithromycin, HIV protease inhibitors, and nefazodone). Each statin Rx was individually determined to have had or not have had a concurrent overlap of therapy of at least one day with an interacting drug listed above (IRx). Simvastatin and pravastatin IRx rates were compared using Chi-square analysis.
RESULTS: 1,285,852 statin Rx claims were identified of which 18,108 (1.41%) were co-prescribed with a drug that should be avoided per the simvastatin PI. For each statin, the frequency of total Rx (TRx) and IRx were: atorvastatin 920,660 TRx (1.35% IRx), fluvastatin 38,049 (1.29%), lovastatin 16,841 (1.48%), pravastatin 130,430 (1.80%), and simvastatin 179,872 (1.46%). Pravastatin was more frequently associated with IRx than simvastatin, p<0.001.
CONCLUSIONS: The prevalence of co-prescribing an oral drug that should be avoided with simvastatin is similar between the statins. Although the rate was higher for pravastatin and statistically significant compared to simvastatin, the absolute rate difference between pravastatin and simvastatin was low (0.34%). Prescribers do not appear to be primarily selecting pravastatin relative to simvastatin when prescribing concurrent drugs that may interact.

117. Evaluation of respiratory drug use patterns in Oregon Medicaid patients who receive Advair® prescriptions. Daniel Hartung, Pharm.D., *Cindy Yeh, Pharm.D.*, Nanette Bultemeier, Pharm.D., BCPS, CDE, Kathy Ketchum, MPA:HA, R.Ph., Michele Koder, Pharm.D., Dean Haxby, Pharm.D.; Oregon State University; Oregon Health and Science University, Portland, OR.

PURPOSE: This study characterized respiratory drug use patterns among Oregon Medicaid fee-for-service members having prescriptions filled for Advair® (salmeterol/fluticasone combination inhaler) between March 1, 2001 and April 1, 2002. The goals of the analysis were to characterize the use of Advair and compare its utilization to current clinical practice guidelines and best available evidence.
METHODS: Prescription drug claims for asthma/COPD-related medications were evaluated during 90 days prior to an initial Advair (sentinel) fill date. Medical claims (ICD-9-CM diagnosis coding) were reviewed to determine the nature of the member's respiratory disease (COPD vs asthma).
RESULTS: Of 1148 patients (mean age = 53 years) identified, 21% had an asthma-related condition alone, 14% had a COPD-related condition alone, and 16% had both COPD and asthma. Prior to the sentinel Advair prescription, 31% of patients received an inhaled corticosteroid (ICS), and 43% of patients were not on any long-term maintenance therapy (e.g. ICS, long-acting β_2-agonist). Of patients not on maintenance therapy, 71.5% also had no short-acting β_2-agonists filled prior to their first Advair fill. Approximately 33% of patients were receiving ipratropium therapy.
CONCLUSIONS: Advair appears to be the initial therapy prescribed for a large proportion of patients with respiratory disease. There is substantial use of Advair in patients with a COPD-related condition based on medical claims, member age, and concomitant use of ipratropium. Current use patterns within the plan indicate significant deviation from accepted guidelines.

118E. A national analysis of outpatient antimicrobial prescribing. *Katie J. Suda, Pharm.D.*, Kevin W. Garey, Pharm.D., Carl T. Bertram, Pharm.D., Larry H. Danziger, Pharm.D.; Baptist Memorial Health Care, Memphis, TN; University of Houston, Houston, TX; Walgreens Health Initiatives, Deerfield, IL; University of Illinois at Chicago, Chicago, IL.

Presented at the 40th Annual Meeting of the Infectious Diseases Society of America, Chicago, IL, October 24-27, 2002.

Pharmacogenomics

119E. The impact of pharmacogenomic factors on steroid weaning in pediatric heart transplant patients using logistic regression analysis. *HongXia Zheng, M.D.*, Steven Webber, M.D., Adriana Zeevi, Ph.D., Erin Schuetz, Ph.D., Jiong Zhang, Ph.D., Pamela Bowman, R.N., Jatinder Lamba, Ph.D., Gilbert J. Burckart, Pharm.D.; University of Pittsburgh, Pittsburgh, PA; St. Jude Children's Research Hospital, Memphis, TN.

Presented at the 23rd Annual Meeting of the International Society for Heart and Lung Transplantation, Vienna, Austria, April 9-12, 2003.

120. Molecular characterization of clinical and laboratory fluoroquinolone-resistant *Streptococcus pneumoniae*. *Ayman M. Noreddin*, Heather J. Smith, Kim A. Nichol, Allan M. Walkty, Daryl J. Hoban, George G. Zhanel; University of Manitoba; Health Sciences Centre, Winnipeg, MB, Canada.

PURPOSE: The aim of this study was to compare the contribution of efflux to ciprofloxacin (cipro)-resistant (MIC ≥ 4 µg/ml) clinical isolates (CLIN) and lab-created mutants (LAB) resistant to cipro, gatifloxacin (gati), gemifloxacin (gemi), levofloxacin (levo), and moxifloxacin (moxi).
METHODS: Cipro-resistant CLIN were collected and their MICs were determined by broth microdilution. Single-step LAB were created from 3 susceptible SPN isolates at 1-16x MIC of cipro, gati, gemi, levo or moxi. The quinolone resistance determining regions (QRDRs) of GyrA and ParC were sequenced in all the CLIN and LAB. The role of efflux was evaluated via reserpine studies for all isolates.
RESULTS: QRDR changes were observed in 14/34 (41%) and 32/34 (94%) of CLIN for GyrA and ParC, respectively. Ciprofloxacin-positive efflux was observed in 12/34 (35%) of the CLIN. Conversely, QRDR changes were observed in 6/39 (15%) of GyrA and 1/39 (2.5%) of ParC in the LAB and 100% of the ciprofloxacin-resistant mutants were efflux-positive. 20% of gati, 44% of gemi, 67% of levo, and 22% of moxi-resistant mutants were able to efflux cipro but none were positive for efflux of the FQ with which they were selected.
CONCLUSIONS: Clinical isolates predominately showed QRDR changes (94% in ParC and 41% in GyrA), but only 35% were positive for efflux. Alternatively, efflux of cipro contributed to 100% of cipro-resistant laboratory mutants whereas only 15% and 2.5% had GyrA and ParC changes, respectively. Resistance in clinical isolates was primarily due to QRDR changes whereas resistance in laboratory mutants was predominately a result of efflux.

Pharmacokinetics/Pharmacodynamics/Pharmacometrics/Drug Metabolism

121. Comparative bioavailability study of two atenolol tablet preparations in healthy Korean male volunteers. In Koo Chun, Ph.D., Sung Ha Kang, M.D., *Hye Sun Gwak, Pharm.D., Ph.D.*; Dongduk Women's University, Seoul, Korea; Chunchon Sacred Heart Hospital, Hallym University, Chunchon, Korea; Chosun University, Gwangju, Korea.

PURPOSE: This study was conducted to compare the bioavailability of a generic product of Ditent® (atenolol from Daewon Pharmaceutical Co., Ltd., Korea) with the innovator product, Tenormin® in 20 healthy Korean male volunteers.
METHODS: The volunteers received a single 50 mg dose of each atenolol formulation according to a randomized, two-way crossover design. Plasma samples were obtained over a 24-hour interval, and atenolol concentrations were determined by HPLC with a fluorescence detector. From the plasma atenolol concentration vs time curves, the following parameters were compared: area under the plasma concentration-time curve (AUC), peak plasma concentration (C_{max}), time to reach peak plasma concentration (T_{max}), and terminal first order elimination half-life ($t_{1/2}$).
RESULTS: No statistically significant difference was obtained between the T_{max} values, and the logarithmic transformed AUC and C_{max} values of the two products. The 90% confidence for the ratio of the logarithmically transformed AUC and C_{max} values of Ditent over those of Tenormin were calculated to be between 0.85 and 1.04, and 0.89 and 1.07, respectively; both were within the bioequivalence limit of 0.80-1.25. The mean of T_{max} in Tenormin group was 3.13 hour, and that in Ditent group was 3.17 hour. The values of $t_{1/2}$ between the two products were found comparable, and the mean values were 5.5 hour in both products.

CONCLUSIONS: Based on these results, it was concluded that Ditent was comparable to Tenormin in both the rate and extent of absorption, indicating that Ditent was bioequivalent to the reference product, Tenormin.

122E. Influence of continuous ambulatory peritoneal dialysis on the kinetics of oral moxifloxacin. *Heino Stass, Ph.D.,* Sandra Dammer, M.S., Dagmar Kubitza, M.D., Jan-Georg Moeller, Ph.D., Heinz Delesen, M.S., Raphael Schaefers, M.D.; BAYER AG, Pharma Research Center, Wuppertal, Germany; University of Essen, Center for Renal and Hypertensive Diseases, Essen, Germany.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

123E. No dose adjustment is needed for patients undergoing hemodialysis receiving oral moxifloxacin. *Heino Stass, Ph.D.,* Sandra Dammer, M.S., Dagmar Kubitza, M.D., Jan-Georg Moeller, Ph.D., Heinz Delesen, M.S., Raphael Schaefers, M.D.; BAYER AG, Pharma Research Center Wuppertal, Germany; University of Essen, Center for Renal and Hypertensive Diseases, Essen, Germany.

Presented at the 42nd Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

124. Simultaneous pharmacokinetic modeling of piperacillin and tazobactam concentrations in rabbit serum and tissue cage fluid. *Chonghua Li, B.S.,* David P. Nicolau, Pharm.D., Charles H. Nightingale, Ph.D.; Hartford Hospital, Hartford, CT; University of Connecticut, Storrs, CT.

PURPOSE: It is clinically significant to ensure that antibiotic level at infection site can be high enough to kill bacteria. A mathematical model was developed to model antibiotic concentration in serum and tissue cage fluid (TCF), a marker of drug in the interstitial, extracellular space.
METHODS: Two sterilized golf whiffle balls were surgically implanted in rabbit dorsal cervical area. After 4-week recovery, the whiffle balls were filled with tissue cage fluid (TCF) and the rabbits were inoculated with 2-ml 10^6 CFU/ml *Pseudomonas aeruginosa*. One day after infection, 400 mg/kg of piperacillin, or piperacillin/tazobactam were injected subcutaneously, 6 rabbits for each regimen. Based on Fick's first law, a mathematical model was developed to simultaneous fit drug in serum and TCF, in which transportation rate constant characterized the drug penetration.
RESULTS: Based on the least weighted sum of squared residuals and the lowest standard error of estimates, piperacillin and tazobactam in serum and TCF were fitted well with this mathematical model. The correlation coefficient of observed and predicted values were greater than 0.9. Volume of distribution (L), absorption rate constant (h^{-1}), elimination rate constant (h^{-1}), and transportation rate constant (h^{-1}) as follows: piperacillin alone, 6.97 ± 1.02, 2.12 ± 0.66, 0.47 ± 0.04, 0.32 ± 0.13; piperacillin with tazobactam, 5.97 ± 2.30, 1.90 ± 0.73, 0.52 ± 0.14, 0.25 ± 0.13; and tazobactam with piperacillin, 2.65 ± 1.01, 1.70 ± 0.70, 0.75 ± 0.20, 0.31 ± 0.15. There is no statistical difference in pharmacokinetics and drug penetration for piperacillin with and without tazobactam.
CONCLUSIONS: This mathematical model can simultaneous fit drug level in serum and tissue, which would be used to predict drug concentration in tissue from the serum profile.

125. Extended-release niacin pharmacokinetics following multiple-dose administration. *Eugenio A. Cefali, Pharm.D., Ph.D.,* Marijke H. Adams, Pharm.D., Ph.D.; Kos Pharmaceuticals, Inc., Miami Lakes, FL.

PURPOSE: This open-label, dose-escalation study compared the pharmacokinetic parameters of niacin and its metabolites after multiple-dose administration of four different daily doses of extended-release niacin (ERN). Niacin and its major metabolites (conjugative: nicotinuric acid [NUA]; non-conjugative: N-methylnicotinamide [MNA] and N-methyl-2-pyridone-5-carboxamide [2PY]) were evaluated. Niacin non-conjugative metabolism is saturable.
METHODS: Subjects received different doses of ERN during four consecutive treatment periods of six days each: 1000, 1500, 2000, and 3000 mg. Doses were administered once daily in the evening with food. Urine was collected for 24 hours prior to the first dose and for 24 hours after the last dose of each treatment.
RESULTS: Twenty-nine subjects (18 M, 11 F) age 40 to 70 years received at least one treatment. For 27 subjects who completed all treatments, mean percent of niacin and NUA in urine increased with increasing doses (12.2, 21.3, 32.4, 41.9% of total dose recovered for 1000, 1500, 2000, 3000 mg/day). The mean percent of MNA and 2PY recovered decreased as the total daily dose increased (87.8, 78.7, 67.6, 58.1% for 1000, 1500, 2000, 3000 mg/day). The ratio of non-conjugative to conjugative metabolites steadily declined with increased doses of ERN (7.2, 3.7, 2.1, 1.4 for 1000, 1500, 2000, 3000 mg/day).
CONCLUSIONS: The decline in metabolite ratio with increased doses of ERN is consistent with previous findings of a saturable, non-conjugative metabolism.

126. Effect of over-the-counter sustained-release niacin on serum transaminases. *Eugenio A. Cefali, Pharm.D., Ph.D.*; Kos Pharmaceuticals, Inc., Miami Lakes, FL.

PURPOSE: Niacin is extensively metabolized to non-conjugative (e.g., N-methylnicotinamide [MNA], N-methyl-2-pyridone-5-carboxamide [2PY]) and conjugative (nicotinuric acid [NUA]) metabolites. Niacin non-conjugative metabolism is saturable, and absorption rate influences metabolite ratio. McKenney, et al. (JAMA, 1994) demonstrated that an over-the-counter sustained-release niacin (OTC-SRN) was associated with a very high incidence of serum transaminase elevations >3 times the upper limit of normal (ULN). Objectives of our study were to investigate the relationship between the pharmacokinetics of the OTC-SRN used by McKenney, et al. and the short-term time course of transaminase elevations.
METHODS: In this open-label study, 6 healthy males (45 to 60 years) received 2000 mg OTC-SRN daily (divided doses, four times daily) for 5 days, then increased to 3000 mg for 5 days. Only the nighttime dose was administered with food. Urine was collected every 6 hours throughout the study.
RESULTS: After 2 days at 3000 mg/day, the study was discontinued due to serum transaminase elevations and related adverse events. Mean transaminases rose approximately 9-fold (AST, 18.5 to 183.2 IU/L; ALT, 17.3 to 166.8 IU/L). Within 6 weeks of study termination, transaminases fell below 1.5 times the ULN in all subjects. With 2000 mg/day, urine recovery of niacin and NUA was negligible; 96% of the recovered dose was MNA and 2PY. Similar metabolite recovery was observed with 3000 mg.
CONCLUSIONS: OTC-SRN for 7 days at 2000 to 3000 mg/day produced significant changes in serum transaminases. The elevations in transaminases were accompanied by extensive urine recovery of non-conjugative metabolites.

127. Topotecan pharmacokinetics in children with Wilms tumor and unilateral nephrectomy. *Lisa C. Iacono, Pharm.D.,* Jeffrey S. Dome, M.D., Clinton F. Stewart, Pharm.D.; St. Jude Children's Research Hospital, Memphis, TN.

PURPOSE: The objective of this study was to compare topotecan disposition in children with Wilms tumor who have had a unilateral nephrectomy with an age-, BSA-, and serum creatinine-matched group of pediatric patients.
METHODS: Five children with Wilms tumor were treated with a 30-minute topotecan infusion on a protracted schedule (daily x 5 x 2 weeks) for one to four courses. Pharmacokinetic samples were obtained before start of infusion and at 0.5, 1, and 6 hours after the end of infusion. A two-compartment model was fit to topotecan lactone concentration-time data using MAP-Bayesian as implemented in ADAPT II. Using standard equations, systemic clearance (Cl) was calculated. Area under the plasma concentration-time curve was calculated using the log-linear trapezoidal method. Topotecan clearance in children with Wilms tumor was compared to an age-, BSA-, and serum creatinine-matched group of pediatric patients receiving topotecan.
RESULTS: A total of 29 topotecan pharmacokinetic studies were performed in the children with Wilms tumor. Topotecan systemic clearance in these patients was similar to that in age-, BSA-, and serum creatinine-matched pediatric patients without Wilms tumor (p=0.09). However, the glomerular filtration rate as measured by technetium clearance in the Wilms tumor patients was significantly different from the cohort of matched patients (p=0.03).
CONCLUSIONS: Although glomerular filtration was decreased in children with Wilms tumor compared to a similar cohort of pediatric oncology patients, topotecan systemic clearance was not. Other mechanisms (e.g., drug transporters) may have compensated for the anticipated decrease in topotecan renal clearance.

128E. Comparative pharmacokinetic analysis by standard 2-stage method versus non-parametric population modeling. *Vincent H. Tam, Pharm.D.,* Sandra L. Preston, Pharm.D., George L. Drusano, M.D.; Albany Medical College, Albany, NY.

Presented at the Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

129E. Stochastic population optimal sampling strategy for levofloxacin based on a population pharmacokinetic model. *Vincent H. Tam, Pharm.D.,* Sandra L. Preston, Pharm.D., George L. Drusano, M.D.; Albany Medical College, Albany, NY.

Presented at the Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27-30, 2002.

Pharmacy Practice

130. Utilization of industry-sponsored medication assistance programs by Alabama pharmacists. *Heath P. Adams, Pharm.D.,* Renee M. DeHart, Pharm.D., BCPS, Katherine C. Herndon, Pharm.D., BCPS, Condit F. Steil, Pharm.D., CDE; Samford University; Medical Center East Family Practice Residency Program; Pfizer Inc., Birmingham, AL.

PURPOSE: Most pharmacists encounter patients limited in their ability to pay for medications. Many manufacturers offer medication assistance programs (MAPs) to assist these patients. However, little information exists concerning the pharmacist's role in the MAP process. Our goal was to examine pharmacists' involvement in MAPs in Alabama, a state where many patients live in poverty.
METHODS: Surveys were mailed to 400 randomly selected pharmacists in Alabama. Demographic data was collected, as well as number of pharmacists that have used MAPs, their role in the process, and characteristics that impact MAP utilization.
RESULTS: Surveys were returned by 155 pharmacists (38.8%). Overall, 46% indicated they were involved in assisting patients with MAPs. No differences between B.S. and Pharm.D. or residency vs nonresidency trained pharmacists existed in MAP use. Of pharmacists using MAPs, 44.3% had assisted 10 or fewer patients, 25.7% had assisted 11-20 patients, and 30% had assisted more than 20 patients. Characteristics that made the MAP process convenient were voucher systems and MAP-refillable prescriptions. The time required to complete applications was identified as the greatest barrier for pharmacists. A substantial portion of pharmacists (58.1%) were not comfortable discussing MAPs with their patients.
CONCLUSIONS: Alabama pharmacists play a role in the use of MAPs, but the number of patients served overall is small. MAP utilization rates among pharmacists may be improved through further education regarding the assistance of underinsured patients, and the streamlining of the MAP process.

131. Salary survey of pharmacists in industry. *Carol C. Manifold, Pharm.D.,* Joan Korth-Bradley, Pharm.D., Ph.D., Charles C. Marsh, Pharm.D., Shellie Rothstein, B.S., MBA, James Tiller, Pharm.D., MBA; Ligand Pharmaceuticals Inc., San Diego, CA; Wyeth Pharmaceuticals, Radnor, PA; Pharmacia, Fort Smith, AR; Novartis Pharmaceuticals Corp., Oxnard, CA.; TAP Pharmaceuticals, Lake Forest, IL.

PURPOSE: The ACCP Pharmaceutical Industry PRN designed and administered a survey to obtain compensation information for pharmacists in industry.
METHODS: A hardcopy survey was sent in 2001 to the PRN (nª340). Copies were forwarded by PRN members to other pharmacists in industry, for an unknown total of recipients. Questions included annual compensation for 2000, practice type, location, sex, years of experience, and highest professional degree or training. The survey was distributed to the PRN again in 2002 (collecting data for 2001), but only to PRN members (nª340) and electronically.
RESULTS: One hundred twenty-five individuals provided data on their 2000 compensation in the 2001 survey; 46 individuals provided data on their 2001 compensation in the 2002 survey. Data were summarized as means when the number of responses was ≥ 3. Overall, the mean salary in 2000 was $99,126 and in 2001 was $105,487. As expected, salaries increased with years of education and training, years of experience, and position level. Salaries did not appear to have any relationship to time traveling. In 2000, women were compensated at 84% of the level of men with similar years of education and training ($91,100 vs $108,000, respectively). This difference was slightly less (87%) in 2001 ($97,509 vs $112,468, respectively). No differences in years of experience as a pharmacist, years of experience in industry, or position title could be discerned to explain this difference. Mean salaries were highest in the Southwest and lowest in the Midwest.
CONCLUSIONS: The PRN plans to continue the survey in future years.

132. Provider satisfaction with a clinical pharmacist-physician team intervention. *Angela B. Hoth, Pharm.D.,* Anjan Bhattacharyya, M.D., Gary E. Rosenthal, M.D., Peter J. Kaboli, M.D.; Iowa City VA Medical Center Program for Interdisciplinary Research in Health Care Organization, Iowa City, IA.

PURPOSE: To evaluate provider satisfaction with a collaborative clinical pharmacist (Pharm.D.)/physician (M.D.) intervention to improve medication prescribing.
METHODS: A novel Pharm.D.-M.D. intervention to improve prescribing was initiated in a VA clinic in patients ≥ 65 years and receiving ≥ 5 medications. The Pharm.D. recommendations were reviewed with a study M.D. who evaluated the patient and discussed final recommendations with the primary provider prior to the patient's clinic appointment. Surveys were mailed to primary providers assessing satisfaction with the following: overall interaction with the Pharm.D./M.D. team, value of recommendations, medication regimen improvement, time saved, effect on patient-provider relationship, influence of physician on recommendation acceptance, improved knowledge of geriatric pharmacotherapy, and willingness to refer patients to such a service. Responses were on a 5-point scale and grouped into agreement, neutrality, or disagreement for analysis.
RESULTS: 30 of 45 (66%) surveys were completed. Providers had practiced outpatient medicine for an average of 5.5 years (range 1-28) and had worked at the VA on average 2.2 years (range 1-5). 80% of respondents agreed that the overall interaction with the Pharm.D./M.D. team was positive and 77% would refer patients to the service if available. Medication regimens improved according to 73% and only 13% felt the recommendations were unnecessary. The intervention saved time in providing patient care (57% agreed) without adversely affecting the provider-patient relationship. The majority of respondents remained neutral (53%) regarding physician presence although 40% stated they were more likely to accept the pharmacist's recommendations since a physician also evaluated the patient. 47% of providers felt the Pharm.D./M.D. interaction improved their prescribing practices in the elderly.
CONCLUSIONS: A Pharm.D./M.D. intervention to improve prescribing in elderly veterans was well accepted by primary care providers in a VA outpatient clinic.

133. The impact of multiple dose inhalers sharing program on utilization resource in a community hospital. *John A. Noviasky, R.Ph., Pharm.D.,* Jon P. Bushnell, R.Ph., Corinne Ritzel, Janice Stone, Linda Kokoszki, R.N., BSN, CIC, James Bramley, M.D.; St. Elizabeth Medical Center, Utica, NY.

PURPOSE: Prior to program initiation, inhalers were issued to each patient in our institution and accounted for $140K annual expenditure. Evaluation of administration data showed that up to 90% of this figure was due to waste (misplaced inhaler, patient discharge, etc). This report describes the effects of initiation of shared inhaler program on utilization and patient safety.
METHODS: Six-month baseline utilization pattern (project period 1, PP1) was determined by comparing purchase data with treatments as recorded by respiratory department. After program initiation, similar data was recorded in six month increments comprising project periods 2 and 3 (PP2 and PP3). Percentage waste was determined by comparing respiratory treatments delivered with number of inhalers purchased for that time period. Potential cross-contamination issues were monitored concurrently by infectious disease department.
RESULTS: After project implementation, the percentage of waste decreased from (%) 68.6 (± 27.9) to 51.9 (± 28.9) in PP2 to 21.0 (± 25.8) in PP3 ($p<0.05$). As expected, the cost per treatment also decreased from ($) 4.84 (± 3.81) to 3.89 (± 5.02) in PP2 to 1.00 (± 0.74) in PP3 ($p=0.15$) and annualized expenditure decreased to about $42 thousand in PP3. Interestingly, the number of (annualized) recorded treatments decreased after program implementation for both β-agonists and steroidal based agents from 42,410 to 34,726 (-18.1%) and 12,496 to 7,027 (-43.8%) respectively. Finally, There was no appreciable change in nosocomial respiratory infections after program initiation.
CONCLUSIONS: Implementation of Shared Inhaler Program has positively impacted resource utilization in this medical center without apparent effect on patient safety or outcome.

134. Development and pre-testing of a patient decision aid to assist pharmaceutical care in the prevention of cardiovascular disease. *Lyne Lalonde, Ph.D.,* Annette O'Connor, Ph.D., Elisabeth Drake, M.S., Pierrette Duguay, R.N., Steven A. Grover, M.D.; University of Montreal at Montreal; µgill University at Montreal; University of Ottawa at Ottawa.

PURPOSE: Studies have shown that pharmaceutical care based on patient's education, evaluation of cardiovascular (CVD) risk, treatment plan and treatment monitoring improves hypertension and dyslipidemia control. Decision Aid (DA) may facilitate such complex intervention.
OBJECTIVE: To develop and pretest a DA for patients with hypertension or dyslipidemia.
METHODS: The DA was developed by five researchers and clinicians and was reviewed by language specialist. A before-after study design was conducted among a convenience sample of patients (n=16) with hypertension and/or dyslipidemia.
RESULTS: The DA is composed of a booklet providing general information and a personal worksheet providing patient specific information on 1) risk factors and estimated CVD risk, 2) estimated benefits of various lifestyle changes and medication options, 3) a plan of action, and 4) a progress summary. Most patients (86%-100%) rated the way the information is presented as excellent or very good, 80% judged the information as balanced and 100% found it useful. After using the DA, patients reported higher mean knowledge scores for risk factors in general (before-after: 91%-100%; p=0.009), personal risk factor (73%-92%; p=0.017), and treatment options (68%-99%; p=0.000). More patients were able to estimate their risk category (50%-93%; p=0.03) and their CVD risk (31%-100%; p=0.00). Less patients reported an overall decisional conflict score > 2.5 (4/16-1/15; p=0.4).
CONCLUSIONS: In this pretest study, the DA was acceptable and improved knowledge and risk perception. A study is ongoing to asses the feasibility of using the DA to support pharmaceutical care.

Psychiatry

135E. Predictors of response to divalproex of placebo treatment in acute mania. Jeffrey A. Welge, Ph.D., Paul E. Keck, Jr., M.D., *Jane M. Meinhold, Pharm.D.*; University of Cincinnati, Cincinnati, OH; Abbott Laboratories, Abbott Park, IL.

Presented at the Annual Meeting of the Institute of Psychiatric Services, Chicago, IL, October 10, 2002.

136E. Sexual dysfunction associated with neuroleptic-induced hyperprolactinemia improves with reduction in prolactin levels. *Bruce J. Kinon, M.D.,* Hong Liu, Ph.D., Jonna Ahl, Ph.D.; Eli Lilly and Company, Indianapolis, IN.

Presented at the 41st Annual Meeting of the American College of Neuropsychopharmacology, San Juan, Puerto Rico, December 8-12, 2002.

137E. Longitudinal effect of olanzapine on fasting serum lipids: a randomized, prospective, 4-month study. *Bruce J. Kinon, M.D.,* Hong Liu, Ph.D., Jonna Ahl, Ph.D., Robert W. Baker, M.D.; Eli Lilly and Company, Indianapolis, IN.

Presented at the 9th Biennial Meeting of the International Congress on Schizophrenia Research, Colorado Springs, CO, March 29–April 2, 2003.

138. Ethnicity and schizophrenia medication choice: haloperidol, risperidone, or olanzapine. *Jayme L. Opolka, M.S.,* Karen L. Rascati, Ph.D., Carolyn M. Brown, Ph.D., P. Joseph Gibson, Ph.D.; University of Texas at Austin; Eli Lilly and Company.

BACKGROUND: Research has shown that patients with schizophrenia may respond better to 2nd generation antipsychotics versus older antipsychotics. However, ethnic variation in the likelihood of receiving newer antipsychotics may be associated with reduced medication adherence and health service utilization, potentially contributing to poor response rates. The purpose of this study was to examine if ethnicity helped predict whether patients with schizophrenia were prescribed 1) haloperidol versus risperidone or olanzapine, and 2) risperidone versus olanzapine, when controlling for other factors.
METHODS: Texas Medicaid claims were retrieved for persons, age 21 to 65, diagnosed with schizophrenia or schizoaffective disorder, initiating treatment with olanzapine (n=1875), risperidone (n=982), or haloperidol (n=726) between 1/1997 and 8/1998. The association between antipsychotic prescribing and ethnicity (African American, Mexican American, or Caucasian) was assessed using logistic regression. Covariates included other patient demographics, region, comorbid mental health conditions, and prior medication and heath care resource use.
RESULTS: The results of the haloperidol versus risperidone or olanzapine analysis indicate that African Americans were significantly more likely than Caucasians to receive haloperidol (odds ratio = 0.657, $p<0.001$). Ethnicity did not result in significant differences in choice of risperidone versus olanzapine.
CONCLUSIONS: When other factors are controlled for, African Americans were significantly less likely to receive the newer antipsychotics. Among those that did receive the newer antipsychotics, ethnicity did not affect medication choice.

139. Onset of action of olanzapine/fluoxetine combination in bipolar depression. Sanjay Dube, M.D., Gary D. Tollefson, M.D., Ph.D., Michael E. Thase, M.D., Susan D. Briggs, Ph.D., Luann E. Van Campen, Ph.D., Michael Case, M.S., *John Plewes, M.D.,* Mauricio Tohen, M.D., Dr. P.H.; 1 Lilly Research Laboratories, Indianapolis, IN; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: This post-hoc analysis investigated the onset of action of olanzapine/fluoxetine combination (OFC) compared with olanzapine monotherapy and placebo for treating bipolar depression.
METHODS: Data were obtained from an 8-week, double-blind placebo controlled study (n=833). The primary efficacy measure was the Montgomery-Asberg Depression Rating Scale (MADRS). Analyses were conducted for traditional analysis, pattern analysis, mixed-effects curvilinear regression, and survival analysis of sustained response. Area under the curve incorporates onset and global effect to assess overall effectiveness.
RESULTS: Traditional analysis revealed significantly greater improvement in MADRS scores at week 1 for OFC versus placebo (-9.55 vs -5.08, $p<0.001$) and for olanzapine versus placebo (-8.31 vs -5.08, $p<0.001$). For pattern analysis, OFC had a significantly greater percentage of early persistent responders (defined as response within two weeks and not followed by a relapse) than the olanzapine or placebo groups (32.4% vs 18.3%, $p<0.05$; and 12.7%, $p<0.001$, respectively). Survival analysis of sustained response revealed a significantly shorter time to sustained response for OFC versus placebo ($p<0.001$), for OFC versus olanzapine ($p<0.05$), and for olanzapine versus placebo ($p<0.05$). Mixed-effects curvilinear regression analysis revealed a significant therapy by time interaction ($p<0.001$). Area under the curve analysis revealed a significantly greater percentage of total possible improvement (48.2%) for OFC vs olanzapine (38.5%, $p<0.01$) or placebo (27.8%, $p<0.001$).
CONCLUSIONS: OFC and olanzapine demonstrated significantly faster onset of action compared to placebo, and OFC showed faster onset of action than olanzapine. Overall, OFC and olanzapine demonstrated rapid and sustained antidepressant action in a sample of bipolar depressed patients.

140. Influence of smoking and gender on olanzapine dosing. *Sheila R. Botts, Pharm.D.,* Jose de Leon, M.D., Francisco Diaz, Ph.D.; University of Kentucky, Lexington, KY.

PURPOSE: Olanzapine is one of the most commonly prescribed atypical antipsychotics and is the leading antipsychotic in dollar sales. Olanzapine has an FDA approved dosing range of 10-20 mg/day but is often used at doses exceeding this range which significantly increases drug costs. Olanzapine is largely metabolized by CYP1A2. Smoking, which induces CYP1A2, is expected to increase clearance of olanzapine by 40%, however, dosage adjustment in smokers is not currently recommended. The influence of smoking on olanzapine metabolism is important, given that approximately three quarters (78%) of schizophrenic patients and 58% of patients with other severe mental illnesses are smokers. Additionally, female gender is expected to reduce clearance by 30%. Many institutions target high-dose olanzapine prescribers in an effort to reduce unnecessary drug costs. However, factors such as smoking or gender may necessitate increased doses.
METHODS: Retrospective review of all patients receiving olanzapine during an inpatient stay at a state psychiatric hospital during 2001. Demographic information and smoking status were collected from the medical chart. Olanzapine in doses ≥ 25 mg/day were considered high dose.
RESULTS: Approximately 1/3 of all patients admitted during 2001 received olanzapine. Nine percent (47 of 530) of olanzapine patients were prescribed high doses. The percentages were similar in females (10%) and in males (9%), in smokers (9%) and non-smokers (9%). Moreover, the mean maximum olanzapine dose was also similar (and not significantly different) in males 14.9 (SD=7.3) mg/day and females 15.4 (SD=7.1).
CONCLUSIONS: Neither gender nor smoking status was associated with receiving a high dose of olanzapine.

Pulmonary

142. Construct validity of medication utilization measures among children with asthma. Ilene H. Zuckerman, Pharm.D., Stuti Sinha, Pharm.D., Van Doren Hsu, Pharm.D., *Mona Tsoukleris, Pharm.D.,* Cynthia S. Rand, Ph.D.; University of Maryland; Johns Hopkins University, Baltimore, MD.

PURPOSE: Medication adherence is an important factor for successful asthma management, especially in children. Identifying non-adherent children early may be helpful in targeting those at risk for asthma-related sequelae. In an effort to create a valid adherence measure, we compared two different asthma medication utilization measures: 1) patient/parent self-report and 2) prescription refill printouts.
METHODS: This study is part of a larger randomized controlled trial assessing effectiveness of a home-based adherence monitoring and feedback intervention in reducing asthma-related emergency room visits in children. Patients complete a baseline survey including demographics, symptoms, health care utilization, and current medications. In addition to the self-reported medication regimen (SRMR), we obtained prescription refill printouts (PRPs) from the patients' pharmacies. Asthma medications were categorized by drug class and dosage form. Using contingency table analysis, we compared medication utilization (yes/no) from SRMR with PRP. In addition to overall percent agreement, we report the κ statistic, which determines the extent of agreement exceeding that expected by chance.
RESULTS: Adherence agreement ranged from good [leukotriene inhibitors (94% agreement, κ=0.60)] to poor [β_2 agonists (51% agreement, κ=0.02)]. Utilization rates were higher for self-report compared to refill records for all drug classes except for oral steroids. Use of 60-day PRPs yielded higher agreement and κ values between the measures compared to 30-day PRPs.
CONCLUSIONS: Generally, there was an increased prevalence of asthma drug utilization by self-report compared to refill records, and the agreement varies by the refill record timeframe. These results are important for further development of a valid adherence measure.

Transplantation/Immunology

143. Efficacy and safety of valganciclovir in prophylaxis of cytomegalovirus disease in renal transplant recipients. *Steven Gabardi, Pharm.D.,* John Powelson, M.D., Steven A. Baroletti, Pharm.D., Jennifer L. Cina, Pharm.D., William C. Goggins, M.D.; Brigham and Women's Hospital; Northeastern University; Harvard University, Boston, MA.

PURPOSE: Valganciclovir is a ganciclovir prodrug, with improved bioavailability. We evaluated the efficacy and safety of valganciclovir, 450 mg daily, for prevention of cytomegalovirus (CMV) disease in renal transplant recipients (RTR) at an urban, academic medical center.
METHODS: A retrospective analysis reviewed all RTR at risk of CMV disease receiving valganciclovir between August 2001 and May 2002. Valganciclovir was started post-operatively and dose-adjusted to renal function. Desired treatment duration was 6 months. Incidence of CMV disease within 6 months posttransplant was the primary endpoint. Secondary endpoints included: leukopenia, thrombocytopenia, acute rejection, allograft loss, early discontinuation of therapy and patient death.
RESULTS: 34 RTR were identified: 50% were men, 20.6% were black, 58.8% received cadaveric kidneys and 8.8% had a prior history of kidney

transplantation. Mean age was 50.5 years. Donor/recipient CMV serostatus was 44.1% donor(+)/recipient(+), 35.3% donor(-)/recipient(+) and 20.6% donor(+)/recipient(-). Anti-thymocyte immunoglobulin induction therapy was administered to 73.6% of patients. All patients received maintenance tacrolimus and mycophenolate, with 94.1% also receiving maintenance prednisone. CMV disease incidence within 6 months posttransplant was 0% and 5.9% at any point posttransplant. Incidence of leukopenia and thrombocytopenia associated with valganciclovir was 17.6% and 26.5%, respectively. No patients developed acute cellular rejection and 5.9% developed humoral rejection. No graft losses or deaths occurred. Early discontinuation of valganciclovir occurred in 14.7% of patients secondary to severe, persistent leukopenia, thrombocytopenia and/or diarrhea. None of these patients developed CMV disease.
CONCLUSIONS: Valganciclovir, 450 mg daily, is effective, safe and well tolerated for prophylaxis of CMV disease in RTR.

144E. Gender differences in glucocorticoid pharmacodynamics in renal transplant recipients. *Kathleen M. Tornatore, Pharm.D.*, Mahfooz Farooqui, M.D., Peter Singh, M.D., Denise Biocevich, Pharm.D., Andrea Ciminelli, Pharm.D., Kristin Gilliland, Pharm.D., Alan Forrest, Pharm.D., Sarah Coutu, Pharm.D., Rocco Venuto, M.D.; University at Buffalo,Buffalo, NY.

Presented at the 35th Annual Meeting and Scientific Exposition of the American Society of Nephrology, Philadelphia, PA, October 30 - November 4, 2002.

145. The effectiveness of hyperlipidemia management in a transplant population. *Kristine S. Schonder, Pharm.D.*, Teresa P. McKaveney, B.S., Kevin J. Lynch, Pharm.D., BCPS; Pfizer, Inc.; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: Cardiovascular disease is the leading cause of death in transplant recipients. Hyperlipidemia is a major contributing factor toward the development of cardiovascular disease and it occurs in up to 80% of transplant recipients. Hyperlipidemia has also been linked to chronic allograft rejection. The purpose of this study was to determine the effectiveness of hyperlipidemia management in a large transplant population base.
METHODS: A retrospective review of computerized utilization records between December 1, 2000 and December 1, 2001 was performed to identify hyperlipidemia in liver, kidney and pancreas transplant recipients. Laboratory values for lipids were examined to determine diagnosis and effectiveness of treatment. The assessment of hyperlipidemia was based on total cholesterol > 200 mg/dl and/or antihyperlipidemic medication utilization.
RESULTS: A total of 3414 transplant patients were included in the analysis. The incidence of hyperlipidemia in this population was 48%; 43% of these patients received antihyperlipidemic medications. Only 32% of patients receiving antihyperlipidemic medications were at the total cholesterol goal of < 200 mg/dl. Low-density lipoprotein (LDL) values were available for 1953 of the total population; 74% were under the LDL goal of < 130 mg/dl.
CONCLUSIONS: While the National Cholesterol Education Program guidelines recommend the monitoring of LDL values, this was measured in only 57% of transplant patients. Even patients who were identified as hyperlipidemic were not effectively managed to lower their cholesterol. Clinicians must be more aggressive in diagnosis, monitoring and treatment of hyperlipidemia to decrease cardiovascular disease and prolong patient survival after transplantation.

146. Clinical experience with repeated courses of thymoglobulin for induction and for treatment of rejection in renal transplant recipients. *Agnes Lo, Pharm.D.*, Brea Olson, B.Sc., Lillian W. Gaber, M.D., A. Osama Gaber, M.D.; University of Tennessee Health Science Center, Memphis, TN.

PURPOSE: The purpose of this study was to describe the clinical course of renal transplant recipients who received two courses of thymoglobulin, one for induction and one for treatment of acute rejection (AR).
METHODS: Retrospective chart review of all kidney transplant recipients transplanted between 01/01/98 and 06/31/02. We included primary renal transplant recipients who received Thymoglobulin for induction and for treatment of biopsy-proven AR.
RESULTS: We evaluated 207 primary renal transplant recipients who received thymoglobulin induction. Ten subjects (4.8%) [9 male, 7 African-Americans, mean age of 43 years, and 8 cadaveric transplants] met the inclusion criteria. The mean follow-up was 374 days. The mean time to AR was 122 (17 to 333) days posttransplant. The Banff grades of the AR were IA (1), IB (2), IIA (1), IIB (2), and III (4). The mean total thymoglobulin induction dose was 5.7± 2.3 mg/kg and the treatment dose was 9.9 ± 3.0 mg/kg, ($p<0.01$). The same degree of reductions in white blood cells, lymphocytes, and platelets were observed during induction and treatment. The mean serum creatinine at AR was 5.3 mg/dl and declined to 3.3 mg/dl after 1 week of treatment, ($p=0.04$). 7/10 subjects had posttreatment biopsies which revealed either improvement or complete resolution of AR. Graft survival was 60% (3 subjects who lost their grafts had grade III AR and chronic rejection and 1 expired with functioning graft). Five patients had infection episodes, but none developed posttransplant malignancy.
CONCLUSIONS: The incidence of steroid-resistant AR in renal transplant recipients induced with thymoglobulin was 4.8%. 70% of patients had histological response to treatment, but was associated with an increased risk of infection. However, subjects with grade III rejection and chronic rejection did not respond to thymoglobulin.

147. Economic analysis of basiliximab and mycophenolate mofetil in living-related donor renal transplant program. *Jason A. Crompton, Pharm.D.*, Aimee Sundberg, Pharm.D., Lonnie Smith, Pharm.D., Troy Somerville, Pharm.D., Jacke Corbett, FNP-C, Edward Nelson, M.D., John Holman, M.D., Fuad Shihab, M.D.; University of Utah Hospitals and Clinics, Salt Lake City, UT.

PURPOSE: The impact of newer immunosuppressive agents has been shown in numerous trials. However, few economic analyses of these agents exist in a living-related donor (LRD) renal transplant population.
METHODS: Between 6/97-10/02, 81 LRDs were analyzed. 27 patients each received three different regimens. All received calcineurin inhibitors and steroids. The first group received azathioprine (AZA) without induction, the second received AZA plus basiliximab (B-AZA), and the final group received mycophenolate mofetil (MMF) plus basiliximab (B-MMF). Impact of the regimens on transplant and readmission charges (including DRG payments), and acute rejection (AR) were analyzed. All charges were adjusted for inflation to 2002 dollars.
RESULTS: 12-month data was available on all patients except 4/27 (15%) B-MMF patients. Cost of initial hospitalization was significantly less expensive between the AZA group and all others ($55,214.28 AZA vs $72,321.35 B-AZA vs $73,106.79 B-MMF, $p<0.05$) and maintained significance when factoring for covariates. No difference in initial hospitalization charges occurred between BAS groups. No difference in number of readmissions, readmission charges or DRG payments, or renal function was found between groups. The B-MMF group experienced zero episodes of AR compared to 4 and 6 episodes in the AZA and B-AZA groups, respectively ($p<0.05$ for B-MMF vs B-AZA). B-MMF results in a cost-effectiveness ratio of $4029.70 per rejection episode saved versus the AZA group and $1687.76 vs the B-AZA regimen.
CONCLUSIONS: Compared to the one-time cost of graft failure of over $20000 (source: HCFA), the use of mycophenolate in a living-related renal donor setting is justified. However, induction with basiliximab may not provide additional benefit and may simply increase cost.

148. Utilizing C_2 to individualize cyclosporine trough concentrations in renal transplant recipients. Aimee K. Sundberg, Pharm.D., Lonnie D. Smith, Pharm.D., K. Troy Somerville, Pharm.D., *Lisa M. McDevitt, Pharm.D.*, John Holman, Ph.D., M.D., Fuad Shihab, M.D.; Wake Forest University Baptist Medical Center, Winston-Salem, NC; University of Utah Hospitals and Clinics, Salt Lake City, UT.

PURPOSE: This study was undertaken to 1) identify the trough cyclosporine (CYA) concentration corresponding to the ideal C_2 in individual patients, 2) examine if this relationship remains constant over time, and 3) determine graft and patient outcomes based on the individualized C_2-directed trough range.
METHODS: A single center, open label, pilot study was conducted in renal transplant recipients. Subjects were ≥18 years of age, on CYA for at least 6 months with a stable dose for 1 month, and using concomitant prednisone and azathioprine/mycophenolate mofetil. Patients taking medications known to interact with CYA and patients with proven or suspected rejection within the previous 3 months were excluded. Both trough and C_2 levels were drawn at clinic visits and the CYA dose was adjusted to reach a C_2 of 600-800 ng/ml. The trough correlating to the goal C_2 in individual patients was identified and each patient was subsequently maintained within the new trough range.
RESULTS: Of 14 total patients (9 male, 3 cadaveric, 2 re-transplants), 12 have reached goal. An average of 2.3 (1-6) visits were required to reach goal. 9/12 patients were maintained at trough ranges that were lower than our institutional protocol directs. No rejections to date and no significant change in SCr. Average CYA dose decreased from 2.87 mg/kg to 2.36 mg/kg with C_2-directed trough ranges.
CONCLUSIONS: C_2 correlates better with AUC but is difficult to implement. Individually correlating trough to ideal C_2 appears to be a safe and effective method of CYA monitoring. Maintaining patients at C_2-directed trough levels may result in lower trough ranges and fewer CYA-associated adverse effects. Longer follow up is needed to determine if the C_2/trough relationship remains constant.

149. Evaluation of the use of darbepoetin alfa in renal transplant recipients. *Lisa M. McDevitt, Pharm.D.*, K. Troy Somerville, Pharm.D., Lonnie D. Smith, Pharm.D., John Holman, Ph.D., M.D., Fuad Shihab, M.D.; University of Utah Hospitals and Clinics, Salt Lake City, UT.

PURPOSE: No data is currently available using darbepoetin alfa in renal transplant recipients (RTR). Anemia is a common problem early after transplantation as well as in patients with suboptimal renal function. This retrospective review was conducted to evaluate the safety and efficacy of darbepoetin use in RTR, identify the dose required to reach a target hemoglobin of 12 g/dl and assess the effect of ACE-inhibitors on response to darbepoetin treatment.
METHODS: All RTR who have received ≥ 1 dose of darbepoetin were

included. The data evaluated includes: Hgb, Hct and SCr values at baseline, 1, 2, 4, 6, 8 and 12 weeks; previous epoetin alfa use; darbepoetin alfa dosing; iron studies; concomitant iron or ACE-inhibitor therapy; incidence of rejection; and adverse events attributable to darbepoetin.
RESULTS: A total of 36 RTR were identified. Seven were converted from epoetin. Anemia occurred primarily within 0-3 months (n=18) or ≥ 1 year (n=16) after transplant. The late anemia group had significantly lower creatinine clearances compared to the early anemia group (p=0.049) yet did not require significantly greater darbepoetin doses (p=0.355). At the time of this review, 28/36 patients have achieved the target hemoglobin of ≥ 12 g/dl. These patients required an average dose of 0.47 mg/kg. Concomitant medications included an ACE-inhibitor (n=17) and iron (n=16). Average Hgb values were within target range by 4-6 weeks regardless of previous epoetin treatment, concomitant ACE-inhibitor treatment, and time of onset of anemia. One episode of late acute rejection (1A) occurred. No adverse events were attributable to darbepoetin.
CONCLUSIONS: Darbepoetin alfa is a safe and effective option for anemia treatment in RTR. Concomitant ACE-inhibitor use did not affect response. Dosing requirements do not vary with changing renal function or time post-transplant.

150. Effects of St. John's wort on tacrolimus pharmacokinetics in healthy volunteers. *Mary F. Hebert, Pharm.D., FCCP,* Jeong M. Park, M.S., Pharm.D., Yu-Luan Chen, Ph.D., Shahzad Akhtar, Anne M. Larson, M.D.; University of Washington, Seattle WA; Fujisawa Research Institute of America, Evanston IL.

PURPOSE: This study documented the effects of St. John's wort (SJW) on the pharmacokinetics of tacrolimus in healthy volunteers.
METHODS: Ten healthy volunteers (8 female; 20-30 years; 8 Caucasian, 2 Asian; 47-90 kg) received 2 oral doses of tacrolimus (0.1 mg/kg), one on day 1 and the other on day 22. On study days 8-25, subjects received SJW 300 mg three times daily with meals. Serial blood samples were collected at times: 0, 0.5, 1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 24, 36, 48, 72 and 96 hours following each tacrolimus dose. Subjects received the same diet on each study day. Tacrolimus concentrations were quantified by an LC-MS/MS assay. Pharmacokinetic parameters were estimated utilizing non-compartmental techniques. Pharmacokinetic parameters are reported as mean ± SD with $p<0.05$ considered significant.
RESULTS: Concomitant SJW administration resulted in a significant decrease in tacrolimus area under the concentration-time curve (306.9 µg•hour/L ± 175.8 µg•hour/L vs 198.7 µg•hour/L ± 139.6 µg•hour/L; p=0.004) and maximum tacrolimus concentration (29.0 ng/ml ± 10.1 ng/ml vs 22.4 ng/ml ± 12.8 ng/ml; p=0.001) and increase in tacrolimus apparent oral clearance (349.0 ml/hour/kg ± 126.0 ml/hour/kg vs 586.4 ml/hour/kg ± 274.9 ml/hour/kg; p=0.01) and apparent oral tacrolimus volume of distribution as steady-state (11.5 L/kg ± 4.3 L/kg vs 17.6 L/kg ± 9.6 L/kg; p=0.04). No significant changes were seen in tacrolimus half-life or time to maximum concentration.
CONCLUSIONS: Concomitant administration of SJW with tacrolimus results in a marked decrease in tacrolimus concentrations, likely through induction of CYP3A and p-glycoprotein.

Urology

151E. Vardenafil improved patient satisfaction with erection hardness, orgasmic function, and sexual experience in men with erectile dysfunction following nerve-sparing radical prostatectomy. *Ajay Nehra, M.D.,* Monica Seger, Ph.D., Harin Padma-Nathan, M.D.; Mayo Clinic, Rochester, MN; Bayer Corporation, Toronto, BC, Canada; Male Clinic, Beverly Hills, CA.

Presented at the Annual Meeting of the American Urological Association, Chicago, IL, April 26-May 1, 2003.

152E. Vardenafil improved patient satisfaction with erection hardness, orgasmic function, and sexual experience in men with erectile dysfunction. *Craig Donatucci, M.D.,* Craig Niederberger, M.D., Marc Thibonnier, M.D., Thomas Segerson, M.D., Wayne G. Hellstrom, M.D.; Duke University, Durham, NC; University of Illinois at Chicago, Chicago, IL; Bayer Corporation, West Haven, CT; Tulane University, New Orleans, LA.

Presented at the Annual Meeting of the American Urological Association, Chicago, IL, April 26-May 1, 2003.

Women's Health

153. Gender bias in the use of β-blocker therapy in heart failure patients: report from the GRACE study. *Marianne McCollum, Ph.D.,* Robert L. Page, Pharm.D., Kavita Nair, Ph.D., Robert J. Valuck, Ph.D.; University of Colorado Health Sciences Center, Denver, CO.

BACKGROUND: The addition of a β-blocker as first line therapy in the treatment of heart failure is well supported, yet these agents continue to be under-utilized, a pattern that may be more apparent in female compared with male patients. The GRACE (Gender-based Access to Care for Heart Failure) study examined overall and gender-based patterns of β-blocker use and all-cause mortality in patients with heart failure.
METHODS: A retrospective review of pharmacy and medical claims data in a Medicare managed care population with ICD-9 codes for heart failure and a minimum of 90 days of data was conducted. The proportion receiving β-blockers and all-cause mortality rates were determined for the entire cohort and by gender. Relative risks and numbers needed to treat were calculated.
RESULTS: Based on pharmacy claims data, 28% (2061/7314) of patients meeting inclusion criteria received at least one β-blocker prescription. Female patients were significantly less likely to receive β-blocker therapy (1061/3906) than male patients (1000/3408, p=0.04). Lower mortality was observed for all patients who received β-blockers compared with those who did not ($p<0.01$). Similar mortality benefits were estimated for male and female patients in stratified analyses.
CONCLUSIONS: Beta-blockers were under-utilized in this population, and a gender bias existed in the prescribing of β-blockers for female patients. Use of β-blockers in female patients was associated with mortality benefits similar to male patients, suggesting that use of β-blocker therapy in all eligible patients with heart failure should be considered.

154. Hormone replacement therapy utilization in Idaho: a retrospective database analysis of HRT trends in relation to mega-trials and guidelines. *Nicole Murdock,* Julie Johnson-Wilkinson, Pharm.D., Rex W. Force, Pharm.D., BCPS, FCCP; Idaho State University, Pocatello, ID.

PURPOSE: To evaluate the prescribing trends of hormone replacement therapy (HRT) in one state's Medicaid population and to determine the effect of megatrials and guidelines on those trends.
METHODS: A retrospective, observational study using a statewide computerized database of Medicaid claims was conducted to evaluate HRT prescribing from January 1993 to July 2002. Eligible patients were those ≥45 years, female, and eligible for Medicaid benefits. Measurements included monthly counts of individual HRT products (oral and transdermal) and the number of unique patients using HRT. A timeline of megatrials and guidelines was established.
RESULTS: The number of eligible patients ranged from 7838 to 12,854 over the study period. At the start of the study 10.9% of patients were using HRT. Usage peaked at 20.1% in December 1999 then gradually declined to 18.1%. The rate of HRT growth appeared to be unaffected by the publication of American Heart Association guidelines (1995) and HERS (1998). The percent of eligible women receiving Prempro grew steadily (+18.9%) once released following the PEPI trial (1995) until 3/2001. Conjugated estrogen (-23.8%) and medroxyprogesterone (-14.9%) had a steady decline while overall estradiol usage increased (+4.4%) over the study duration. The percent of eligible women receiving combination therapy increased after the PEPI trial (1995) but also continued to increase after HERS (1998).
CONCLUSIONS: Prescribing trends of HRT products did not appear to directly reflect recommendations of major guidelines or megatrials.

155. Effect of lansoprazole on the vaginal ecosystem in healthy women. Katina Christopher, M.S., *Jacqueline S. Marinac, Pharm.D.,* Thomas Mathews, D.O., Betty Herndon, Ph.D., Charlott Williams, R.N., Chao Sun, M.D., MPH; University of Health Sciences; University of Missouri at Kansas City, Kansas City, MO.

Lansoprazole, a commonly prescribed proton pump inhibitor, blocks gastrointestinal acid production. It is unknown if this effect also occurs outside the GI tract. The pH of the vagina in premenopausal women is 3.5-4.5. The diagnosis of bacterial vaginosis (BV) with 3/4 criteria: pH greater than 4.5, + Whiff test, + clue cells and thin homogenous discharge. Some have suggested the pH is the greatest predictor of vaginal ecosystem status; pH greater than 4.5 is 100% sensitive and 92% specific for aerobic pathogens. (Caillouette JC, et al. Am J Obstet Gynecol 1997;176:1270-77.)
PURPOSE: Determine the effect of 14 days of lansoprazole 30 mg (Prevacid®) on vaginal ecosystem.
METHODS: 21 healthy, pre-menopausal women, (age 30.6 years) were enrolled. Women taking hormones, vaginal infection, IUD, confounding medications, douching, consuming yogurt were excluded. Phydrion pH paper was used. The vaginal wall was swabbed at baseline (cycle 9.7 days), after 7 days and 14 days lansoprazole, and washout (next cycle 10.3 days). Other BV criteria were recorded.
RESULTS: Baseline vaginal pH was less than or equal to 4.5 in 19/21, 5.0 in 2 women. During lansoprazole, pH increased by 0.5 in 7, 1.0 in 3, and 1.5 in 1 woman. Day 14 lansoprazole, 10/20 had pH 5.0 or greater, 2 pH 5.5. One developed vaginal candidiasis on drug. At washout, 12/15 had vaginal pH less than or equal to 4.5. Four reported local symptoms.
CONCLUSIONS: Lansoprazole increased vaginal pH in 10/20 women to 5.0 or greater. This effect appeared reversible. It is unknown whether this is a direct effect or mediated by an indirect mechanism. Further work in progress.

156E. Effect of lansoprazole on vaginal Lactobacillus colonies. Katina Christopher, M.S. III, *Jacqueline S. Marinac, Pharm.D.,* Thomas Mathews, D.O., Betty Herndon, Ph.D., Charlott Williams, R.N., Chao Sun, M.D. MPH;

University of Health Sciences; University of Missouri at Kansas City, Kansas City, MO.

Presented at the 51st Annual Clinical Meeting of the American College of Obstetricians and Gynecologists, New Orleans, LA, April 26-30, 2003.

157. Physician knowledge and attitudes regarding hormone replacement therapy. *Julie M. Wright, Pharm.D.,* Susan Miller, Pharm.D., Brenda Rogers, M.D., Hiral Choksi; University of Missouri at Kansas City, Kansas City, MO.

PURPOSE: To assess primary care physician knowledge of published hormone replacement therapy (HRT) studies and to illustrate current attitudes and prescribing patterns for HRT.
METHODS: A 33-item multiple-choice survey was distributed to 770 Family Practice, Internal Medicine, and OB/GYN physicians. Knowledge and perceptions of HRT articles (WHI, HERS II) were assessed. Respondents indicated HRT prescribing patterns and selected courses of action for five case scenarios. Results were summarized using descriptive statistics. Chi square test was used to compare differences between predetermined groups.
RESULTS: One-hundred nineteen (15%) surveys were returned. Based on knowledge of HRT studies, respondents reported a decline of 77% in frequency of HRT use. Osteoporosis prevention (36%) and treatment (28%) were the most common indications for continued HRT use, most likely by OB/GYN physicians (p=0.03). More than 90% avoid HRT use for CHD or cancer prevention. Physicians are comfortable prescribing HRT for menopausal symptoms (87%). A majority of respondents (75%) read the WHI study, but data recall was limited and often inaccurate. More academia associated physicians read the WHI study and recognized study details (p=0.06). From two case scenarios, most (> 80%) physicians indicated HRT discontinuation in a 55-year-old woman prescribed HRT for primary or secondary cardiovascular protection, but > 13% opted to continue HRT, most likely OB/GYN physicians (p=0.06).
CONCLUSIONS: Recent studies have impacted physicians' attitudes and prescribing patterns. Physician specialty and type of practice influenced knowledge and perception of HRT usage. Study results were potentially influenced by the low return rate and use of forced response items.

158. Impact of a community pharmacy-based women's health education program. *Mario M. Zeolla, Pharm.D.,* Jennifer Cerulli, Pharm.D., BCPS; Albany College of Pharmacy, Albany, NY.

PURPOSE: To examine the impact of a community pharmacy-based menopause education program on scores of the Management of Menopause (MoMs) survey. The MoMs survey is administered to HMO customers by the National Committee for Quality Assurance (NCQA) to determine the level of menopause-related education offered by their health care providers. The primary outcome is a comparison of average MoMs scores of subjects at baseline and 3-months post-education.
METHODS: Women aged 47-55 years able to provide informed consent were enrolled. Subjects completed a baseline MoMs survey. A trained pharmacist conducted a one-on-one education session regarding health consequences of menopause, treatment options and known risks and benefits. Follow-up MoMs surveys were administered by mail at 3-months post-education. The survey is scored on a 100-point scale for an overall composite score, and includes three sub-sections: exposure, breadth and personalization of counseling.
RESULTS: A total of 30 subjects were enrolled with 22 completing baseline and 3-month MoMs surveys. Mean 3-month composite MoMs scores (74.5 ± 32) significantly improved from baseline (43.2 ± 32.8; $p<0.05$). Scores on each sub-section also significantly improved at 3-months: exposure scores 55.3 ± 48.6 to 84.9 ± 35.2 ($p<0.05$), breadth scores 43.9 ± 33.1 to 67.4 ± 35.2 ($p<0.05$), personalization scores 30.3 ± 35.5 to 71.4 ± 38.9 ($p<0.05$). Satisfaction with the education session was high, with a median satisfaction rating of 5 (range 4-5) on a 5-point Likert scale.
CONCLUSIONS: A community pharmacy-based menopause education program significantly increased scores on the MoMs survey, and subjects were satisfied with this program.

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.

159E. Implementation of a Microsoft Access™ database for documenting pharmacists' interventions. *Timothy A. Jones, Pharm.D.,* Jackson A. Como, Pharm.D., Mark W. Todd, Pharm.D., FASHP; University of Alabama Hospital, Birmingham, AL.

Presented at the 37th Midyear Clinical Meeting of the American Society of Health-System Pharmacists, Atlanta, GA, December 11, 2002.

160. Cost-avoidance associated with infectious diseases clinical research. Elizabeth S. Dodds Ashley, Pharm.D., BCPS, Barbara D. Alexander, M.D., John R. Perfect, M.D., *Richard H. Drew, Pharm.D., M.S., BCPS*; Duke University Medical Center, Durham, NC.

PURPOSE: Cost-containment measures are often focused on decreasing pharmaceutical budgets while attempting to maintain clinical services. An underutilized method of avoiding pharmaceutical acquisition costs is to provide therapy at no cost through patient participation in clinical trials. We determined medication cost-avoidance and financial support associated with our participation in two research protocols.
METHODS: Duke Medical Center acquisition costs (adjusted to 2002 dollars) were determined for: 1) participants in a clinical trial evaluating an investigational drug for CMV prophylaxis in solid organ transplant recipients and 2) patients receiving liposomal amphotericin B as part of an open-label evaluation for treatment of suspected or documented invasive fungal infections. For study 1, the costs included were: costs of complete oral prophylaxis regimens and avoided costs of CMV-immune globulin (5 doses) and intravenous ganciclovir (2 weeks) that are administered to this risk group per institutional protocols. Costs included for study 2 were from lipid amphotericin B use that was diverted to study supplies.
RESULTS: Both interventions provided equivalent therapy (and outcomes) to our standard-of-care. For study 1, $120,000 in CMV immune globulin and ganciclovir costs were avoided. Provided study medications were valued at an additional $57,000. A cost-avoidance of $193,000 was calculated from participation in study 2. This $370,000 savings was in addition to dispensing revenue generated by the Investigational Pharmacy. Pharmacist salary support (0.5 FTE for both studies) was also provided.
CONCLUSIONS: Pharmacist participation in clinical trials can provide a funding source for clinical pharmacist positions and significantly decrease pharmacy drug acquisition expenditures.

161. Discontinuing raloxifene in hospitalized patients. *Andrea R. Decker, Pharm.D., BCPS,* Colleen C. Harrell, Pharm.D., Louis C. Kynard, B.S., MBA; St. Vincent Mercy Medical Center, Toledo, OH.

PURPOSE: Raloxifene use is associated with an increased risk of venous thromboembolism. The manufacturer recommends discontinuing raloxifene at least 72 hours prior to and during prolonged immobility (post-surgical period and prolonged bed rest) and restarting therapy when the patient is fully ambulatory. Because many hospitalized patients have risk factors for venous thromboembolism, a process to discontinue raloxifene during the hospital stay was considered.
METHODS: A report was generated daily that listed all patients prescribed raloxifene from January 1 to December 31, 2001. Pharmacists prospectively reviewed patient charts and made recommendations to hold raloxifene in surgical patients, immobile patients, and patients with other targeted risk factors for venous thromboembolism.
RESULTS: Of the 29 patients with a documented chart review, 15 (52%) patients had a targeted contraindication or precaution to raloxifene including: 2 patients with active deep venous thrombosis (DVT), 1 patient with a history of DVT and pulmonary embolism, 4 surgical patients, 6 immobilized patients, and 2 patients on both conjugated estrogen and raloxifene. Pharmacists made 14 interventions to stop raloxifene therapy and 8 (57%) were accepted. Based on these results, a decision was made by the Pharmacy and Therapeutics Committee to automatically hold all raloxifene physician orders upon hospital admission. A multidisciplinary policy and procedure was developed and implemented.
CONCLUSIONS: Raloxifene therapy is automatically discontinued when a patient is hospitalized to reduce the risk of venous thromboembolism.

162. Decision analysis of adverse drug events in a community hospital. *Patricia A. Gelatko, Pharm.D.*, Richard Giannini, Pharm.D. candidate, Sheila Schumann, B.S., Douglas J. Swanson, Pharm.D.; Warren General Hospital, Warren, PA

PURPOSE: Interventions designed to identify adverse drug events (ADE) may have a positive impact on clinical outcomes including patient length of stay (LOS). The purpose of this analysis was to evaluate clinical pharmacy interventions designed to identify patients at high risk for an ADE in a community hospital.
METHODS: Clinical pharmacy interventions were designed to proactively identify patients at risk for common ADE's. These clinical interventions, which were developed and approved in cooperation with the medical staff, included patient allergy assessment, patient specific warfarin therapy, culture and sensitivity (C and S) review of anti-microbial therapy, pharmacokinetic consultation, adverse drug reaction assessment, and drug interaction assessment. A decision analysis was designed to evaluate clinical interventions with a clinical endpoint of patient's LOS. Clinical chance nodes in the decision analysis included change in drug therapy, modifying dose, and discontinuing the drug. The clinical outcome was defined as length of stay. An interdisciplinary panel of the hospital's patient safety and quality improvement committees reviewed the findings.
RESULTS: The study was initiated in July of 2002 and is ongoing. A monthly mean of 436 interventions have been documented with a mean of 1537 patient days per month, an intervention incidence of 28.4%. Frequency of the clinical interventions defined by the analysis, included patient allergy

assessment (34%), patient specific warfarin therapy (49%), C and S review (12%), pharmacokinetic consultation (2%), adverse drug reaction assessment (2%), and drug interaction assessment (1%). Significance of clinical pharmacy interventions identified in the decision analysis, included patient allergy (change in drug therapy, p=0.007), warfarin therapy (modifying dose, p=0.04), C and S review (change in drug therapy, p=0.02), pharmacokinetic consultation (changing dose, p=0.04), and drug interactions (discontinuing drug therapy, p=0.001). No significance was documented for adverse drug reaction interventions. Clinical interventions for warfarin therapy (p=0.005) and pharmacokinetic consultation for anti-microbial agents (p<0.01) were statistically significant when compared to extended length of stay. Statistical significance for the other clinical intervention categories was not evident for extended length of stay.
CONCLUSIONS: Clinical pharmacy interventions designed to identify possible ADE's, have a positive impact on patient care in a community hospital. A decision analysis of documented interventions indicated a significant effect on patient length of stay for warfarin therapy and pharmacokinetic consultation.

163. Hypertension management clinic: an innovative multidisciplinary approach. *Denise Waddell, Pharm.D.,* Martha Salazar, Pharm.D., Lisa Sliter, Pharm.D.; Gainesville VA Medical Center, Gainesville, FL.

The Hypertension Management Clinic is a program developed by a clinical pharmacist, 3 registered nurses and 1 physician to improve the control of hypertension in our veteran population. The clinic provides intensive, patient-specific education and goal setting as well as medication management to attain the blood pressure goal set by their provider or most recent published standards of care. In order to see patients more efficiently, the clinic is designed such that up to 10 patients may be scheduled into one clinic session. The registered nurses triage the patients, obtain vital signs, and provide an overview of hypertension in the form of a slide presentation. Either the clinical pharmacist or physician then determines the plan for the patient, including adjustment of medications and follow up. The group clinic is held each Wednesday afternoon from 1-3pm and every other Thursday morning from 9-11am. Primary Care Pharmacy residents and Pharm.D. clerkship students also participate in the clinic. Other disciplines such as pharmacy, psychology, and nutrition also provide educational lectures on a rotating basis. The clinic has reduced the number of primary care provider visits related to the follow up of hypertension and has therefore increased provider availability. The goals of the clinic are to reduce hospitalizations, morbidity and mortality associated with hypertension through intensive management, education and follow up.

164. Impact of a pharmacist-operated lipid clinic in a rural Veteran's Administration medical center. *Todd S. Paulsen, Pharm.D.,* Lourdes M. Heuermann, Pharm.D., Janelle L. Wormuth, Pharm.D., Ravi Pathak, Pharm.D.; University of Nebraska Medical Center, Omaha, NE; Veteran's Administration Nebraska-Western Iowa Health Care System, Grand Island, NE.

PURPOSE: To test the hypothesis that a pharmacist-operated lipid clinic is more effective in attaining the low-density lipoprotein cholesterol (LDL-C) goal in patients with documented coronary heart disease (CHD) as compared with attainable data from physician-operated clinics in the United States.
METHODS: Medical records of 1500 lipid clinic patients treated at the Veteran's Affairs Grand Island Medical Center between 1998 and 2002 were reviewed. Fasting plasma lipid values were retrospectively collected from 425 records that met the following inclusion criteria: a diagnosis of CHD, at least three scheduled clinic visits, and TG values less than or equal to 399 mg/dl. Results were compiled in an Excel spreadsheet and compared with the outcomes of the Lipid Treatment Assessment Project (L-TAP) and Quality Assurance Program (QAP) studies.
RESULTS: Of the patients who met the inclusion criteria, 69% achieved an LDL-C of < 100 mg/dl, 84% ≤ 110 mg/dl, and 95% < 130 mg/dl. Average number of patient visits to the lipid clinic was seven (SD 3.3). Seventy-three percent of patients with a history of coronary artery bypass graft (CABG) achieved LDL-C goal.
CONCLUSIONS: L-TAP and QAP examined physician effectiveness in attaining National Cholesterol Education Program (NCEP) recommended lipid goals for CHD in community practice nationwide and found that LDL-C goal was reached in < 25% of CHD patients. Compared to physicians, this pharmacist-operated lipid clinic was more effective in attaining LDL-C goals (18-25% vs 69%).

165E. Implementation of a pharmacist-managed amiodarone monitoring clinic in the Department of Veterans Administration Medical Center. *Helen Kourlas, B.S., Pharm.D.,* Amy E. Martin, B.S., Pharm.D., Nino Marzella, B.S., Pharm.D.; Long Island University, Brooklyn, NY.

Presented at the 2002 Eastern States Conference, Baltimore, MD, May 2002.

166. Clinical pharmacy involvement in a multidisciplinary heart failure education team at a major academic institution. *Sheel M. Patel, Pharm.D., BCPS,* Amy L. Seybert, Pharm.D., James Coons, Pharm.D., Melanie Shatzer, R.N., MSN, Srinivas Murali, M.D.; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: To describe clinical pharmacy involvement in a multidisciplinary heart failure (HF) management team, focusing on educational needs of hospitalized patients.
METHODS: HF is the leading cause of cardiovascular death in the United States and the #1 discharge related diagnosis among hospitalized patients. Nationally, patients with HF have a 31-day readmission rate of 18-21%, in contrast to a 31% readmission rate at our institution. Lack of adherence with dietary and medical therapy represents the leading cause of preventable readmission. As a result, a multidisciplinary team, dedicated to patient education, consisting of physicians, nurses, dietitians, cardiac rehabilitation specialists and clinical pharmacists was established. The goals of the program are to establish clinical practice guidelines based upon published guidelines, educate patients about their disease and medical management to ultimately reduce readmission rates. Team activities include: enforcing use of standardized admission and discharge orders, evaluating appropriateness of interventions, communication among team members, and assessing continuity of care. During an interview, clinical pharmacists assess patient's knowledge of disease and management reinforcing the purpose, side effects, dosing/administration and adherence of each medication.
RESULTS: The implementation of this program has contributed to a reduction in 31-day readmission rates for patients with HF from 31% to 20% at our institution.
CONCLUSIONS: Clinical pharmacy involvement is a valuable component in a HF management program that can improve clinical outcomes and reduce costs. The success of our team has prompted expansion of our clinical model throughout the health system.

167. Developing an interdisciplinary approach for primary prevention of cardiovascular disease in a family medicine teaching clinic. *Marie-Claude Vanier, B.Pharm., M.Sc.,* Solange Boucher, M.Sc, R.N., Michel Pitre, M.D., Michel Racine, M.D., Nathalie Hudon, B.A. Psy., M.Sc., Lyne Lalonde, B.Pharm., Ph.D.; Unité de Médecine Familiale, Cité de la Santé de Laval; University of Montreal; Aventis Pharmaceuticals, Montreal, PQ, Canada.

Adequate hypertension and hypercholesterolemia control may prevent cardiovascular disease (CVD). However, long-term adherence to pharmacotherapy is very low.
SETTING: University affiliated teaching clinic (teaching physicians:5ETP; family medicine residents:22; pharmacist:0,5ETP; nurse:1ETP).
PURPOSE: To develop an interdisciplinary intervention to optimize hypertension and hypercholesterolemia control. Patient education combined with tailored approach to lifestyle changes and medication based on patient's preference will result in greater adherence to treatment and better hypertension/cholesterol control.
METHODS: The intervention was developed by a pharmacist, a clinical nurse, family medicine physicians and researchers in primary care.
RESULTS: Physician refers patients to pharmacist when initiation of pharmacotherapy is indicated or if therapeutic result is suboptimal. Pharmacist is responsible for 1) taking patients history with emphasis on past experience with medication plus adherence issues; 2) providing patients with a decision aid (DA) tool to prepare them for an informed and joined decision about future treatment; and 3) making treatment recommendations to physician. After consulting the DA, patients meet their physician to negotiate treatment plan. They receive counseling on selected lifestyle changes by a clinical nurse and teaching of blood pressure self-measurement if needed. Thereafter, a systematic follow-up, based on the treatment plan documented in the DA, is shared by all health professionals to intensify and personalize the intervention.
CONCLUSIONS: This intervention, based on real professional collaboration, is supported by the use of a DA, designed to enhance patient's participation in decision making and to focus health care interventions around patient's preferences. A pilot study is on-going to assess its feasibility.

168. Pharmacist's impact in a multidisciplinary heart failure protocol. Katie J. Suda, Pharm.D., *Shannon W. Finks, Pharm.D., BCPS,* Melissa J. Neglia, Pharm.D., Mary Ann Northern, R.N., B.A.; Baptist Memorial Health Care, Memphis, TN.

PURPOSE: HF is associated with hospital re-admissions and high mortality rates. A multidisciplinary protocol was initiated in 1/1/01 to provide comprehensive health care to hospitalized HF patients. This study evaluated a clinical pharmacist's impact to optimize drug therapy regimens and provide education.
METHODS: The medical records of HF protocol patients were prospectively reviewed from 1/1/01 to 12/31/01. The pharmacist focused on optimal medication(s) and patient/family education. 2000 and 2001 financial data was extracted from hospital records. A two-tailed student's t-test was used for statistical analysis.
RESULTS: 186 patients were included in the protocol. All patients had ejection fractions diagnostic of systolic HF (average=25%). Medications prior to admission included remodeling/after-load reducing agents in 48% of indicated patients, this increased to 100% at discharge. Pharmacists reviewed

the majority of patients' drug therapy regimens (82%) and provided patient/family education (89%). Although the pharmacist usually recommended additional drug therapy, this had little impact on the average pharmacy acquisition cost in 2001 ($608.77) when compared to 2000 ($528.07; p=NS). Overall, the protocol had little impact on length of stay (8.1 vs 8 days), but did decrease total hospital costs ($5252 vs $4716). However, the re-admission rate significantly decreased from 26.2% in 2000 to 16.2% in 2001.
CONCLUSIONS: After a pharmacist's intervention, patients received optimal HF drug therapy and education more frequently than at baseline. Pharmacists can impact a HF patient's drug therapy regimen without increasing pharmacy costs. HF protocols may not save hospital costs acutely, but may defer future costs by decreasing re-admission rates.

169. Real-time drug dosing recommendations in patients with renal insufficiency. *Erkan Hassan, Pharm.D.,* Michael J. Breslow, M.D., Brian Rosenfeld, M.D.; VISICU, Baltimore, MD.

PURPOSE: In patients with renal insufficiency (RI), clinicians usually avoid adding nephrotoxic drugs, but may devote insufficient attention to currently ordered drugs. Even computerized physician order entry systems only provide appropriate dosing recommendations for new drugs, but cannot correct dosages for prior orders. We describe a software application that reviews data within an electronic medical record, identifies developing RI, and alerts clinicians to medications requiring dosage adjustment.
METHODS: With each serum creatinine result entered into the ICU clinical database, the application calculates creatinine clearance (CrCl) using the Cockroft-Gault equation and identifies patients with new RI (Cr CL < 50 ml/minutes). Renally excreted medications (REMs) are then identified by comparing the patient's current drugs to a table containing REMs. For each REM, the program presents evidenced based dosing recommendations appropriate for the level of renal function (CrCl 10-50 ml/minutes or CrCl < 10 ml/minutes). The application also notifies clinicians when new REMs are ordered and when CrCl improves to > 50 ml/minutes. A survey of users found a high degree of clinical acceptance (91 of 117 alerts - 77.8%) and a perception of increased patient safety. Future evaluation will examine the effect of this application on the incidence of adverse effects.
CONCLUSIONS: Automating notification of deteriorating renal function and providing specific dosing recommendations creates an electronic safety net, eliminating dependence upon physician recognition of changing renal function and recall of appropriate dosing recommendation. The introduction of this type of decision support, delivered in real-time, may help to reduce major adverse drug events.

170. Consumer use of Web-based drug and health information. *Brenda L. Gleason, Pharm.D.,* Shelly J. Enders, Pharm.D., Brian J. Seiz, Pharm.D., Sheldon G. Holstad, Pharm.D.; St. Louis College of Pharmacy, St. Louis, MO.

PURPOSE: Millions of consumers are accessing drug and health information via the World Wide Web, making it the most sought after information on the Internet. However, what type of information consumers are seeking and what they are doing with their newfound knowledge is unknown. Furthermore, it is unclear if this information empowers consumers to take an active role in their health care. Through a non-profit, consumer-oriented, drug and health information Web site, *www.DrugDigest.org*, a mode for two-way communication was developed to better understand consumers' needs, opinions on drugs and web-based information, and how they use web-based information.
METHODS: Opinion polls and surveys were posted on *www.DrugDigest.org*. Feedback was sought on various topics including use of generics, trust in Web site information, usefulness of drug and health information, and how web-based information is affecting changes in consumer involvement in their health care.
RESULTS: Responses have been collected from 3,005 consumers in the first 9 months. By way of example, 60% of respondents always request generic substitution when getting a new prescription, and 76% deemed generics as effective as brand drugs. Sixty-eight percent use the Internet to double-check their doctor's recommendations, and 42% report discussing the information with their doctor or pharmacist. Forty-three percent most trust Web sites that provide referenced information. Complete findings and lessons to be learned from our opinion polls and surveys will be presented.
CONCLUSIONS: This mode of two-way communication can increase insight into consumers' views on drugs and how Web-based drug and health information may be influencing consumers' involvement in their health care.

171E. Effectiveness of a program to educate pharmacists in the proper response to resuscitation efforts. *Dennis Woods, Pharm.D.,* Karen Marlowe, Pharm.D., BCPS; Auburn University, Auburn, AL.

Presented at the Annual Meeting of the Pediatric Pharmacy Advocacy Group, Vancouver, BC, Canada, 1999.

172. Student use of personal digital assistants on senior pediatric clinical clerkships. *Holly D. Maples, Pharm.D.,* Donna S. West, Ph.D., Charlotte Hubbard, Cindy D. Stowe, Pharm.D.; University of Arkansas for Medical Sciences, Little Rock, AR; Louisiana Tech, Ruston, LA.

PURPOSE: To describe the application of personal digital assistants (PDAs) by pharmacy students on pediatric clerkships.
METHODS: Fourth-year pharmacy students on three different pediatric clerkships were asked to participate. Student participants completed a survey and then were given a Handspring Visor Deluxe® to use throughout the rotation. The software on each PDA was as follows: Pediatric Lexi-Drugs™, ePocrates Rx™, mobile MicroMedex™, Tarascon's Pocket ePharmacopoeia™, Medical MathPad, ABG Pro, MathLib, Parens Lite calculator, MedCalc, and STAT GrowthCharts™. Upon completion of the rotation, in-depth interviews were conducted. The interview guide was based on the adoption literature. Descriptive statistics were used to describe the demographic data, and qualitative data analysis was used to analyze the interview transcripts.
RESULTS: Twenty students participated in the study. Seventy percent of the students owned a PDA, 90% liked using a PDA, and 95% opted to use the provided PDA. In general, students liked using the PDA primarily because of convenient information access. Specifically, students used the provided PDA because of the Pediatric Lexi-Drugs software available on it. Students mainly used the PDA in the following ways: 1) as a reference source (e.g. accessing drug information); 2) interactive data management (e.g. kinetic calculations, determination of growth percentiles, etc.); and 3) administrative-type activities (e.g., monthly calendar).
CONCLUSIONS: It appeared that having access to information during rounds improved students' confidence in participating and providing information in a timely fashion. The PDAs were a welcomed addition to the rotation from both the students' and preceptors' opinions.

173. Incorporating Internet search as a core component of internal medicine clerkship to develop pharmacotherapy updating skills. *Eunice P. Chung, Pharm.D.;* Western University of Health Sciences, Pomona, CA; Huntington Memorial Hospital, Pasadena, CA.

BACKGROUND: Knowledge, skill, and attitude are critical components of pharmacy education. However, efforts are generally tilted to knowledge component vs skill development and fostering self-learning attitudes. Because pharmaceutical care evolves continuously, more efforts should be directed to equipping students with skills necessary to keep up with the changes. Easy accessibility and plethora of information makes Internet an attractive tool in developing these skills.
METHOD: Our institution utilizes electronic learning software, blackboard, to place course materials on the Internet. A course for internal medicine clerkship was created on the blackboard. External links were created to Web sites the students are required to utilize during the clerkship. The direct links include, major medical journals, food and drug administration (FDA), sites linked to clinical practice guidelines, and government funded medical Web sites. Students are required to review the contents of the major medical journals and FDA Center for Drug Evaluation and Research Web site. Pharmacotherapy update session is held on a weekly basis to discuss the pertinent new finding. Direct links are also used to report adverse drug events to FDA Medwatch and to obtain major clinical practice guidelines.
RESULTS: This process allows students to learn how to keep up, interpret, and incorporate new findings into clinical practice. Many students adopt these habits and continue to utilize these skills beyond this clerkship.
CONCLUSIONS: Six weeks is insufficient amount of time to obtain all internal medicine related knowledge. Therefore, the Internet-based pharmacotherapy updating skills may serve as an critical component in transitioning students to a clinician.

174. Can a pharmacist make an impact on glycemic control in patients with type 2 diabetes? *Jennifer D. Goldman-Levine, Pharm.D.;* Massachusetts College of Pharmacy and Health Sciences, Boston, MA.

PURPOSE: This study is being done to determine the impact of a pharmacist on glycemic control of patients with type 2 diabetes who require medication (oral or insulin) in a family practice clinic. It is my conviction that including a pharmacist on an interdisciplinary team to provide diabetes education, education and training on self-monitoring of blood glucose and diabetic diets, medication counseling, initiation, adjustments and management of drug therapy will positively affect the HgA_{1c}. This improvement may potentially prevent the long-term complication of diabetes.
METHODS: A computer list of all patients who were seen or are to be seen for the management of type 2 diabetes from July 1 2001 to December 31, 2002 in our clinic will be generated. Patients will be included if they have been treated for type 2 diabetes for at least 6 months. A chart review will be performed comparing the glycemic control of patients whose drug therapy was/is managed by a pharmacist as part of the medical team versus those patients without a pharmacists' involvement. Secondary analysis of other data to be collected will determine if appropriate laboratory data or tests are being done in the recommended time frame (i.e., yearly) and are within goals in the comparative groups. These include: complete lipid panel, blood pressure, urine microalbumin status, and dilated eye exam.
RESULTS: Data collection is ongoing. Results are pending. It is anticipated that there will be at least 50 patients in each group.

CONCLUSIONS: Research in progress.

175. Potential pharmacist role to ensure appropriate metformin prescribing in a tertiary care teaching hospital. *Roy Guharoy, Pharm.D.,* Jeanna Marraffa, Pharm.D., Bishoy Luka, Pharm.D., Donald Blair, M.D.; SUNY, Upstate Medical University, Syracuse, NY.

PURPOSE: Numerous cases of metformin-associated lactic acidosis have been reported in the literature. We conducted a retrospective evaluation in our institution to determine whether prescribing practices in accord with contraindications and precautions.
METHOD: The study was approved by the Institutional Review Board and included 179 adult inpatients and 7 outpatients in the HIV clinic who received metformin identified through hospital pharmacy record. Contraindications to metformin therapy included serum creatinine greater than 1.4 mg/dl in females and 1.5 mg/dl in males; pharmacologically managed heart failure; metabolic acidosis; and radiocontrast media procedures lacking the recommended time between drug re-initiation. Precautionary conditions included patients > 80 years of age; elevated transaminases; cationic drug use; chronic obstructive pulmonary disease, acute myocardial infarction or sepsis.
RESULT: In the inpatient setting, 24% of patients that received metformin had one contraindication to therapy, with only 34% of these patients having metformin discontinued secondary to the contraindication. 30% of patients received metformin with at least 1 precautionary condition identified. Medicine (25%) and Surgery (44%) service patients had at least one contraindication and 77% of medicine patients had at least one precautionary condition. In the HIV clinic, three patients had both one contradiction and one precautionary condition.
CONCLUSIONS: As reported in the recent literature, metformin continues to be inappropriately prescribed despite current usage guidelines. Our data will be presented to the Medical Staff Quality Improvement (MSQI) Committee leading to the potential implementation of a policy for the use of metformin. In addition, a renal dosing protocol has been established to enable pharmacists to manage therapy in patients with renal dysfunction, which will allow for further monitoring of metformin.

176. A community pharmacy based medicine cabinet cleanup campaign. Mikki L. Johle, Pharm.D. candidate, *Melinda M. Neuhauser, Pharm.D.,* Kevin W. Garey, Pharm.D.; University of Houston, Houston, TX.

PURPOSE: It is likely that a large amount of unused medications exist in households throughout the USA. This reservoir of unused medications poses a significant risk to patient safety and public health overall. This study implemented a community pharmacy based medicine cabinet cleanup campaign to 1) determine the quantity and types of unused medications in the community, and 2) establish an effective method for collection and disposal.
METHODS: A drug drop-off site was instituted at a local community pharmacy from Apr-Sept 2002. Advertisements were placed in prescription bags and throughout the pharmacy. Two articles were published in a local area newspaper. Participation was encouraged through a monthly $50 raffle. Collected medications were transported on a weekly basis to the College of Pharmacy for data entry and disposal. Medication name, OTC/prescription status, original and remaining quantity were documented.
RESULTS: During the 6-month study period, 1315 medications were returned. 70% of the returned medications were prescription, 29% were OTC, and 9% were samples. Oral pills (capsules or tablets) were most frequently returned (69%) followed by liquid (13.5%), creams (12%), and inhalers (8%). The most frequent drug classes were NSAIDS/pain (24%) followed by cough/cold/allergy (15%), anti-infectives (11%), and cardiac (10%). > 17,000 oral pills were collected during the study period.
CONCLUSIONS: This study collected an enormous amount of unused medications from all drug classes during a brief time period using a relatively inexpensive and easy process. Large-scale programs to collect this reservoir of unused medications should be instituted throughout the United States.

177. Controlling Utah Medicaid drug spending through a regimen review program. *Karen M. Gunning, Pharm.D., BCPS,* Joanne LaFleur, R.Ph., Gary M. Oderda, Pharm.D., MPH, Bill Stockdale, MBA, Patricia L. Orlando, Pharm.D., Carin Steinvoort, Pharm.D., Kim Dang, Linda S. Tyler, Pharm.D., Diana I. Brixner, R.Ph., Ph.D.; University of Utah, Salt Lake City, UT.

PURPOSE: To decrease the cost of prescription drugs in Medicaid by working with prescribers to improve the quality of medication regimens.
METHODS: A contract was developed between the state and the college of pharmacy to provide consultative services. Data were collected from prescription claims and submitted diagnostic codes. Medication profiles of the top 200 utilizers of prescription benefits each month were reviewed. Predetermined categories of concern included therapeutic duplications, drug/drug interactions, drug/disease interactions, inappropriate doses, additive toxicity, inappropriate duration of therapy, untreated indications, treatment without an indication, and brand dispensed with generic available. Other drug therapy concerns were addressed. Letters were sent to prescribers to address identified problems, and phone consultation was offered for providers with questions and concerns.
RESULTS: As of October 2002, 1000 patients have been reviewed. The first 200 patients reviewed in May were followed through August, and demonstrated a 3.1% decrease over those three months in overall drug expenditures. This compares to the 11.9% increase in annual drug expenditures in the non-reviewed Medicaid population. Overall, the number of patients with more than 7 non-exempt prescriptions has decreased from 5593 in May 2002, to 3849 in August 2002.
CONCLUSIONS: This project, while in its infancy, represents a collaboration between a college of pharmacy and a state Medicaid program. If the trend toward a reduction in the number of prescriptions and the overall drug expenditures for reviewed patients continues, this suggests a $157,181 annual decrease for the first 200 patients and $1.9 million for 2400 patients reviewed annually.

178. The development of an innovative formulary management service. *Laura A. Katz, Pharm.D.,* Sarah V. Muench, Pharm.D.; Wayne State University, Detroit, MI; William Beaumont Hospital, Royal Oak, MI.

INTRODUCTION: To contain costs, insurance companies have a formulary of accepted medications. After Medicaid adopted a closed formulary, the outpatient clinic in our institution received a significant increase in telephone calls from patients requesting non-formulary consideration. Prior authorizations (PA) were completed by a doctor or nurse without consideration of the formulary alternative. This led to the development of a Formulary Management Service (FMS) to further evaluate each member's request.
PURPOSE: The purpose of this study was to evaluate the value of a pharmacist-directed Formulary Management Service.
METHODS: A FMS was offered five afternoons per week for 6 months. The pharmacist reviewed medical charts to determine if a formulary alternative was appropriate. After pharmacist assessment, physicians were contacted to discuss the change or completion of a prior authorization. All interventions were tabulated and documented in the medical record. At the end of 6 months a survey was used to evaluate physician satisfaction of the FMS.
RESULTS: During the study period 161 requests were made. The clinical pharmacist was successful in providing a formulary alternative for 106 (66%) requests thus eliminating need for PA. Drug classes with the most interventions were proton pump inhibitors (22%), antidepressants (11%), insulin (8%), and antihypertensive agents (8%). Thirty-five (87%) physicians responded to the satisfaction survey. The mean rating for value of the service was 4.4 on scale of 1-5 (1= not valuable, 5=extremely valuable). The rating for professionalism of the pharmacist and availability to answer formulary questions was 4.5, 4.2 respectively.
CONCLUSIONS: The evaluation of a pharmacist-directed FMS was viewed as a valuable service. After reviewing these results the outpatient clinic decided to expand this service to manage our Medicaid Health Maintenance Organization (HMO) with over 2,000 members assigned to our institution.

179E. Is there consistency in warfarin monitoring at different ambulatory care settings within the Veteran's health system? *Christine M. Miller, Pharm.D.,* Denise Waddell, Pharm.D.; North Florida/South Georgia Veterans Health System, Gainesville, FL.

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180. Comparison of medication interventions made by clinical pharmacists when an HIV inpatient service was changed to an HIV consult service. *Shana M. Gunderson, Pharm.D.,* Robert C. Glowacki, Pharm.D., BCPS, John Seeger, Ph.D., Pharm.D., Kevin W. Garey, Pharm.D., Joseph Pulvirenti, M.D.; University of Illinois at Chicago, Chicago, IL; Cook County Hospital, Chicago, IL; Harvard University, Boston, MA; University of Houston, Houston, TX.

PURPOSE: Hospitalizations have declined since the introduction of highly active antiretroviral therapy (HAART) leading to disbandment of some HIV specialty units. In these settings inpatient care has shifted to generalists. This may lead to medication errors with a potential increased role for clinical pharmacists (CP).
METHODS: Cook County is an inner-city teaching hospital where HIV infected patients once admitted to specialty units (1999) are now admitted to general medicine services (2001) with HIV consultation available. Medication interventions (MIs) recommended by CP participating on HIV inpatient units (primary) and on the HIV consult service (consult) were recorded routinely. Information collected and compared over 3 months from each time period included: type and frequency of MIs, medications involved, and physician acceptance.
RESULTS: Significantly more MIs were recommended by consult, 905 (1.0 MI/inpatient-day) compared to primary, 600 (0.27 MI/inpatient-day) (RR=3.78, 95% CI: 3.41-4.20), with an acceptance rate >90% for both services. MIs based on anti-infective class remained similar, while recommendations based on MI category statistically varied between the services. Fewer patient counseling and dosage adjustment recommendations were made on consult (RR=1.36, 95% CI: 0.96-1.94 and RR=3.08, 95% CI: 2.54-3.73, respectively) while more recommendations were made to start and discontinue drug therapy (RR=7.2, 95% CI: 5.36-9.77 and RR=8.52, 95% CI:

6.08-12.16, respectively).
CONCLUSIONS: With the change of HIV admissions to general medicine services, a CP spends more time correcting medication errors and less time counseling patients. Lack of counseling can lead to reduced adherence to medications, and an increase risk for HIV treatment failure and disease progression.

181. Implementation of a pharmaceutical care program to identify and intervene on antiretroviral prescribing errors in a large teaching hospital. *Helene Hardy, Pharm.D.,* Gail Burniske, Pharm.D., Yelene Itkin, Pharm.D., Maryann Hawes, Pharm.D., Paul Skolnik, M.D.; Boston Medical Center; Massachusetts College of Pharmacy, Boston, MA.

PURPOSE: This pilot program was designed to document the antiretroviral prescribing errors occurring in a large inner city teaching hospital in which a computerized prescriber order entry (CPOE) and an outpatient computerized medical record system are in place.
METHODS: From October to December 2002, Pharm.D. students and pharmacy residents were trained by a pharmacist specialized in HIV therapy to evaluate prospectively the accuracy of orders for antiretroviral agents (ARVs), look for dosage errors, missing medications and potential drug or food interactions. Each patient's inpatient orders were compared with his or her outpatient regimen as detailed by the patient or the outpatient computerized medical record. Interventions were classified as follow: Dosage or frequency adjustment, drug-drug or food interaction, medication omission, wrong drug or formulation ordered. All interventions were reviewed by the HIV specialist and recorded in an access database.
RESULTS (preliminary): Between October 1 and November 5, thirty nine patients were reviewed by the pharmacist. Twelve interventions were made on ARVs including seven dose adjustments and five new orders for ARVs omissions. No drug-drug or drug food interactions were noted. Two interventions were made on medications used for prophylaxis of opportunistic infection.
CONCLUSIONS: Antiretroviral prescribing errors occur commonly despite the use of CPOE. Most prescribing errors identified in this program reflect the lack of inpatient providers' knowledge concerning HIV therapy and suboptimal use of critical clinical information. Innovative ways of providing HIV pharmacotherapy information to busy practitioners are crucial even when prescribing antiretrovirals using a CPOE.

182. Development of a medication education clinic within a human immunodeficiency virus clinic. *John M. Conry, Pharm.D., BCPS;* St. John's University, Jamaica, NY.

The Peter Krueger Clinic for the Treatment of Immunological Disorders (PKC) at Beth Israel Medical Center serves approximately 1100 patients infected with HIV. The clinic serves a socioeconomically disadvantaged patient population that is ethnically and racially diverse and reflective of the changing demographics of the HIV epidemic. The PKC provides primary care as well as specialty clinic services (e.g., mental health, dental, dermatology, ophthalmology, nutrition, alternative medicine, adherence). The adherence service has been in existence for several years and is managed by a psychologist, health educator and peer educator with a goal of improving antiretroviral treatment adherence.
Despite the comprehensive nature of care provided at PKC, additional services are frequently requested by patients and providers. In an attempt to enhance adherence services and to provide a unique, formalized pharmacy service for patient and provider issues, a medication education clinic (MEC) was developed in October 2002. A pharmacist manages the MEC, which meets two mornings per week in an examination room within PKC thereby allowing easy provider access. Patients are referred by their providers or through self-referral and may be scheduled for appointments or come to the clinic as walk-ins. Services being provided by the MEC are medication counseling, development of individualized patient medication schedules and smoking cessation counseling. Additionally, the MEC affords PKC providers an opportunity for pharmacist consultation at defined times during the week. Documentation of all MEC interventions and follow-up is being performed and appropriate analyses will follow to determine its impact.

183. Experiences at a botulinum toxin clinic: a novel approach to pharmaceutical care services. *Orly Carter, Pharm.D.,* Gordon Smith, Mark B. Bromberg, M.D., Ph.D.; University of Utah Hospitals and Clinics, Salt Lake City, UT.

Botulinum toxin has been used clinically for the past two decades to treat a variety of disorders characterized by pathologically increased muscle contraction. FDA approved indications include blepharospasm, strabismus, cervical dystonia, and brow furrow. Off-label uses such as spasticity, migraine/tension headaches, spasmodic dysphonia, and focal hyperhidrosis are widely established. Botulinum toxin preparations, which have high affinities for uptake by cholinergic neurons, exert effects through organ-selective temporary chemodenervation when injected under EMG guidance near a nerve that controls the target organ. We developed a botulinum toxin clinic utilizing a pharmacist working in conjunction with physicians to optimize therapy with these agents. Patients are interviewed before the scheduled visit with the physician. Pharmaceutical services provided include 1) Obtaining medication histories, specifically assessing use of anticholinergic agents and benzodiazepines for symptom relief of dystonia; 2) Assessing efficacy of botulinum toxin injection (i.e., determination of wearing off effect, lack of efficacy); 3) Evaluating safety relating to serious side effects such as dysphagia, excessive muscle weakness, and ptosis; 4) Reconstituting and/or diluting botulinum toxin according to injection site specifications and botulinum type; 5) Calculating dose of botulinum toxin when switching between toxin types; 6) Providing written and verbal counseling about botulinum toxins. These pharmaceutical services also serve to minimize the amount of botulinum toxin wasted and thus decrease overall costs. Patient demographics and other data will be presented at the poster.

184. Improving patient safety in the antineoplastic medication-use system at a VA medical center with the development of a multidisciplinary clinical team. *Tracie J. Sannicandro, B.S., Pharm.D.,* Robert T. Means, Jr., M.D., Ligaya Z. Aquino, R.N., C.S., ACNP, Stephen W. Cagle, R.Ph., Shauna L. Collier, Pharm.D., Shirley L. Cooper, R.N., Audrey L. Gray, R.Ph., Martha F. Magill, R.Ph., Beth A. Powell, R.N., MSA, Kate I. Smith, R.N., Diane L. Styk, R.N., MSN, CCRN; Ralph H. Johnson Veterans Administration Medical Center, Charleston, SC.

PURPOSE: The Charleston VAMC lacked a standardized, evidence-based, and multidisciplinary approach to the antineoplastic medication-use system. Objectives were to assess compliance with published guidelines, identify areas necessitating improvement, and develop and implement guidelines and clinical protocols. The final objective was to evaluate compliance after implementation of the patient safety improvement project.
METHODS: A pharmacist questionnaire was developed and administered. In order to measure compliance with prescribing guidelines, pharmacists completed a data checklist for each agent reviewed. Flow charts were also designed to map out the antineoplastic medication-use cycle.
RESULTS: Eight pharmacist questionnaires and 50 antineoplastic prescribing order checklists were completed and evaluated. Seven major areas to focus on were identified: 1. Prescribing 2. Labeling 3. Dose checking verification 4. Information access 5. Training, competency, and education 6. Clinical protocols and 7. Computerized prescriber order entry (CPOE). Evidence-based guidelines were developed for procurement and storage, prescribing, pharmacist dose checking verification, labeling, pharmacist/technician education, computerized documentation, reconstitution/dilution and admixtures, preparation and handling, and patient education. Seven clinical protocols were developed. Standardized equations were adopted. A computerized information folder was created. CPOE has been developed for one protocol. A pharmacy training manual is under development.
CONCLUSIONS: Our antineoplastic medication-use system was found to be non-compliant with published guidelines. Several guidelines and treatment protocols were developed to address steps in the process that needed improvement. The next steps are to develop CPOE for the seven treatment protocols and antineoplastic agents and then to evaluate our compliance after implementation.

185. Implementation and utilization of computerized parenteral nutrition orders in a community pediatric hospital: analysis of processing efficiency and medication safety. *Elora Hilmas, Pharm.D.,* Catherine M. Partyka, M.D., Sinai Hospital of Baltimore, Baltimore, MD.

PURPOSE: Analysis was done to determine if computerization of pediatric parenteral nutrition orders utilizing Microsoft Excel® will result in improved processing efficiency and medication safety.
METHODS: Analysis was conducted from October 2001 to September 2002. The number of entries requiring physician input, the number of calculations that needed to be done, and the time to process an order were analyzed to evaluate processing efficiency. Also, the number of calls made to clarify orders due to errors was analyzed to monitor medication safety. Errors were defined as incomplete orders, illegible orders, math errors, and incorrect selections.
RESULTS: 152 paper order forms and 442 computerized order forms were audited. To create a complete order, the paper-based system required 60 entries and 16 calculations by the physician. The computerized order sheet required 16 entries and no calculations. Using survey data, a conservative estimate of five minutes per order was saved due to computerization. Currently in our institution, this would result in an estimated 306 hours per year saved for pharmacy (approximately $10,710 in pharmacist salary) with another 171 hours saved for the medical staff. In terms of medication safety, 25% of paper-based orders had errors requiring a call to the physician for clarification, vs 1.6% requiring calls with the computerized form. ($p<0.0003$).
CONCLUSIONS: Computerization of pediatric parenteral nutrition orders reduced errors and improved medication safety while saving valuable processing time for pharmacists and physicians.

186. Development of departmental guidelines for use of octreotide in the management of chylothorax following cardiothoracic surgery in pediatric patients. *Ada Z. Koch, Pharm.D.,* Dominic Sanfilippo, M.D.; Spectrum Health–DeVos Children's Hospital, Grand Rapids, MI.

PURPOSE: This project analyzes recent clinical literature to 1) review current pharmacological and non-pharmacological suggestions for management of pediatric chylothorax, and 2) develop departmental guidelines for octreotide use in cardiac pediatric patients with post-operative chylothorax.
METHODS: MEDLINE search was performed using search terms such as chylothorax, octreotide, somatostatin and children. Only the articles discussing post-operative chylothorax were selected and included in the final analysis. Reviewing the current literature, various pertinent variables in regards to octreotide were evaluated and taken into account during the development of the departmental guidelines.
RESULTS: No conclusive guidelines for pharmacological management regarding chylothorax in pediatric post-operative patients exist in the current literature. Thus, the following guidelines were developed: after diagnosis of chylothorax, concomitant therapy utilizing low fat diet or MCT enteral formulas, and octreotide 20 µg/kg/day SC in 3 divided doses was initiated. In addition, multivitamins were added to this regimen. Chyle output was evaluated at 72 hours after start of therapy. If chyle output remained the same or increased, octreotide was increased by 10 µg/kg/day not to exceed 40 µg/kg/day. If chyle output decreased by 30%, then current dosage was continued for 72 hours then evaluated again. When chyle output ceased or was at acceptable levels, octreotide was tapered by 5 µg/kg/day until discontinuation.
CONCLUSIONS: No established guidelines exist for pharmacological treatment of pediatric post-operative chylothorax. Non-pharmacological management seems to be the standard of care of those patients. Octreotide may be helpful if used properly. Departmental guidelines are useful and may help to optimize octreotide treatment.

187. Surveillance and intervention of warfarin interactions at an anticoagulation clinic. *Virginia Howe, Pharm.D.,* Jennie Yee, Pharm.D. candidate; Santa Clara Valley Health and Hospital Systems, San Jose, CA.

PURPOSE: This study investigated warfarin drug-drug interactions (DDI) encountered by the pharmacist for patients enrolled in an anticoagulation clinic to: (1) quantify the number of daily DDI's with warfarin: (2) evaluate the most often DDI interventions utilized; and (3) to identify the offenders with warfarin.
METHODS: Computerized daily prescription reports commencing May 2, 1996 through December 31, 2001 were reviewed. Daily prescriptions for all enrolled anticoagulation clinic patients dispensed within the institution were imported into the anticoagulation clinic computer tracking system from the pharmacy computer system. Daily totals were collated for: (1) prescriptions dispensed; (2) DDI's with warfarin; (3) new DDI's with warfarin; (4) interventions by contacting the physician to change the offending drug; (5) interventions by adjusting the warfarin dose to accommodate the offending drug.
RESULTS: On an annual basis, the new DDI with warfarin ranged from 2.2% to 3.6% of the total prescriptions dispensed (4394 to 13,233). The new DDI's ranged from 9.0% to 13.3% of the total DDI's with warfarin. The number of interventions by notifying the physician to change the offending drug ranged from 10% to 21% with a range of 44% to 100% concurrence with an alternative medication. The remaining new DDI's with warfarin were monitored with repeat lab tests ranged from 56% to 80%. The top five offending new DDI's were: (1) acetaminophen/ hydrocodone [106]: (2) sulfamethoxazole/trimethoprim [SMZ/TMP 99]; (3) prednisone [95]; (4) furosemide [85]; and (5) amiodarone [29]. There has been a large reduction in the number of SMZ/TMP (79%) and erythromycin (48%) prescriptions from their highs in 2000 and 1997, respectively.
CONCLUSIONS: Monitoring the lab effects of the interacting drugs was the most utilized intervention; however for more significant offenders, contacting the prescribing physician and recommending a less potent offender resulted in a marked reduction of these prescriptions over the past five years.

188. Applying a pharmacoeconomic model to assess the impact of clinical pharmacy services. *Alice C. Lee Martin, Pharm.D., CDE,* Susan J. Morikawa, Pharm.D., CDE, BCPS, Theresa Ng, Pharm.D., CDE, Shonda M. Hampton, Pharm.D.; Kaiser Foundation Health Plan of the Mid-Atlantic States, Inc., Rockville, MD.

PURPOSE: The ECHO (Economic, Clinical, and Humanistic Outcomes) model is proposed as an ideal method of evaluating the impact of clinical pharmacy services. Few studies, however, describe the comprehensive achievement by clinical pharmacy services consisting of all three parameters. We applied this model to our managed care setting.
METHODS: We reorganized current outcome reporting to include all three variables for each clinical pharmacy service by enhancing our relational databases and incorporating results from routine patient and provider satisfaction surveys. When internal data was not available, estimates were obtained from the literature.
RESULTS: E (Net annualized): Anticoagulation clinic (ACC): Due to reduced adverse events: $3.4 million estimated; Cholesterol risk reduction (CRR): Due to total cost avoidance: $1.3 million estimated; Diabetes (DM) clinic: Due to total medical expenses: $6.4 million estimated; Pharmaceutical Care Service (PCS): Due to optimizing cost-effectiveness of therapy: $3.32 million calculated. C: ACC: Average of 55-65% of INRs within goal; CRR: Approximately 80% achieved Health Plan Employer Data and Information Set (HEDIS) goal; DM: Average A_{1c} reduction of 2.1%; PCS: One clinic documented over 2700 patient profile reviews/6 months. H: The vast majority of patients (97%) and practitioners (94%) reported high to very high satisfaction with clinical services. Patients were willing to pay for pharmacist consultation (60%).
CONCLUSIONS: Our clinical pharmacy services developed diverse and robust outcome measures that validate the value to the organization. It is vital to communicate our achievements for continued support and expansion of our services.

189. Impact of pharmacist involvement in a diabetes management clinic. *Leigh Ann Ramsey, Pharm.D.,* Marshall Bouldin, M.D., Alison Ligon, B.S., Lisa M. Murphey, Pharm.D., Charmaine D. Rochester, Pharm.D., James J. Pitcock, Pharm.D., Margaret B. Pitcock, Pharm.D.; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: To determine whether medication therapy management by pharmacists in an interdisciplinary Diabetes Management Clinic (DMC) lowers hemoglobin A_{1c} (A_{1c}) values and improves compliance with standards of diabetes care.
METHODS: Retrospective analysis of medical records of pharmacist-managed DMC patients was performed. Three or more visits between August 1, 2000 and July 31, 2001 were required for selection. Records were reviewed for initial and final A_{1c} values. Documentation of microalbuminuria, lipid panel, dilated ophthalmologic examination, and aspirin use was assessed. For patients with dyslipidemia or hypertension, low-density lipoprotein (LDL) values or blood pressure (BP) readings were evaluated.
RESULTS: 80 patients met eligibility criteria: 65.0% female, 62.5% African-American. The average initial A_{1c} was 9.9% and mean duration of diabetes was 9.6 years. An average decrease in A_{1c} of 2.2% from initial to final visit was observed. Fifty-three percent of patients achieved an $A_{1c} < 8\%$, while 38% achieved the A_{1c} goal of < 7%. Documentation of microalbuminuria (92.5%), lipid panel (83.8%), funduscopic examination or referral to ophthalmologist (91.3%), and aspirin use (47.5%) was observed. Of the patients with dyslipidemia (65.0%), 42.9% achieved LDL < 100. Hypertension was documented in 75.0% of patients; 31.7% attained a systolic BP ≤ 130 and 60.7% a diastolic BP ≤ 80.
CONCLUSIONS: Mississippi has the largest diabetes population in the United States. The majority of patients are not achieving nationally recognized treatment goals under usual care. This innovative model, involving pharmacists in medication therapy management, is effective in decreasing A_{1c} and complying with standards of care. Clinical outcomes observed will be used to justify reimbursement for pharmacist services.

190. Economic outcomes of pharmacist asthma management in a Medicaid population. *Leigh Ann Ramsey, Pharm.D.,* Lisa M. Murphey, Pharm.D., Rebecca L. Wood, Pharm.D., H. Joseph Byrd, Pharm.D., Charmaine D. Rochester, Pharm.D., James J. Pitcock, Pharm.D., Margaret B. Pitcock, Pharm.D.; University of Mississippi Medical Center, Jackson, MS.

PURPOSE: To determine whether services provided in a pharmacist-managed adult asthma clinic decrease the direct cost of emergency department (ED) visits and hospitalizations in a Medicaid population.
METHODS: Retrospective analysis of ED and hospital utilization data was completed for Medicaid beneficiaries managed in the Adult Asthma Pharmaceutical Care Clinic at the University of Mississippi Medical Center. The study interval constituted one year prior to clinic referral compared to one year after referral. Eligible patients were followed in the Asthma Clinic for at least 12 months and attended at least 2 visits during that time. Enrolled patients acted as their own historical controls. The number of ED visits, hospitalizations, and associated cost to the Medicaid program during the study interval were analyzed.
RESULTS: 21 patients were evaluated: mean age – 43.2 years, 90.4% women, 95% African-American. The number of ED visits decreased by 28% after Asthma Clinic management. Although the number of hospitalizations did not decrease, hospital costs decreased by 48%. The overall cost savings was $55,755 and the annualized rate of cost savings per Medicaid beneficiary was $2,655. All statistical comparisons were significant.
CONCLUSIONS: This evaluation is based on beneficiary data retrieved from the Mississippi Division of Medicaid, who reimburses pharmacists for asthma disease management. This study demonstrated decreased cost associated with clinical pharmacy disease management and will be used to justify a higher reimbursement rate for pharmacist services.

191. Use of PDAs to improve the prevalence of pharmacokinetics use in prescribing vancomycin and aminoglycosides. *Kimberly M. Moyers, Pharm.D.,* Mark Sullivan, Pharm.D., MBA, BCPS; Vanderbilt University Medical Center; Nashville, TN.

PURPOSE: To evaluate the dosing of vancomycin and aminoglycosides before and after the implementation of a pharmacokinetics program, and to improve the use of these antibiotics in an academic institution.
METHODS: Before implementation of the pharmacokinetics program,

medical records of fifty patients taking vancomycin or an aminoglycoside were reviewed. Doses and drug plasma concentrations were documented. A spreadsheet using Documents to Go™ was loaded into personal digital assistants (PDAs) for staff and clinical pharmacists. Four one-hour programs with continuing education credit were developed and presented to all pharmacists. After implementation of the program, a washout period was allowed and then an additional fifty medical records were reviewed. Statistical analysis was done comparing each set of data.
RESULTS: To be concluded.
CONCLUSIONS: To be concluded.

192. Evaluation of clinical pharmacist's interventions in an intensive care setting. *Amal Al-Agil, B.Sc. Pharm.*, Abdulrazaq S. Al-Jazairi, Pharm.D., Yousif A. Asiri, M.S., Ph.D., Tariq Al-Kholi, M.D., Nathem Akhras, Pharm.D., Bashar Horanieh, M.S.; King Faisal Specialist Hospital and Research Center; King Saud University, Riyadh, Saudi Arabia.

PURPOSE: This study sought to evaluate clinical pharmacists' interventions in an intensive care setting with regard to their acceptability by medical team, clinical significance, and targeted patients' outcomes.
METHODS: This is a pilot, prospective, non-randomized, descriptive study evaluating clinical pharmacist interventions in critical care settings in 600 consecutive patients. The study was conducted in a 19-bed Cardiac Surgery Intensive Care Unit at King Faisal Specialist Hospital and Research Center, 600-bed tertiary-care hospital, Riyadh, Saudi Arabia. The clinical pharmacist performed daily medical team rounds, with documentation of all of his interventions. On the same day, a physician, who is a part of the team, verified all interventions for their real presence and significance. The institutional Research Advisory Committee and Ethics Committee approved the study.
RESULTS: The clinical pharmacist intervened 394 times on the 600 patients [0.66 intervention-per- patient]. The medical team accepted almost all interventions (94.9%). The main drug-related problems were as follow: "no drug prescribed for medical condition", "inappropriate dosing regimen", and "no indication for drug use", 33.2%, 28.9%, and 14.3%, respectively. Most of the interventions targeted enhancing therapeutic effect and prevention of adverse drug reaction, 55.7%, and 21.8%, respectively. The interventions with high clinical significance, defined as intervention that may have resulted in decreasing mortality, prevention or reduction of organ damage, or decreasing hospitalization, represented 8.1% of all interventions.
CONCLUSIONS: Participation of clinical pharmacists in daily medical team rounds in intensive care setting significantly reduces unfavorable morbidities and enhances therapeutic outcomes.

193. Community pharmacists' role in cardiovascular patient care in the Republic of Ireland. *Lisa E. Vivero, Pharm.D.*, Kate Mulvenna, B.Sc. Pharm., Martin C. Henman, Ph.D.; Trinity College Dublin, Dublin, Ireland; North Eastern Health Board Primary Care Unit, Meath, Ireland.

PURPOSE: The North Eastern Health Board (NEHB) region of Ireland (population 330,000) has the highest cardiovascular disease death rate in Ireland. Consequently, the Primary Care Unit of the NEHB set out to investigate the role of community pharmacists in cardiovascular health care. The objective of this study was to assess pharmacists' contribution to patient medication compliance and education.
METHODS: Patient medication records were used to identify cardiovascular patients in 13 community pharmacies. Pharmacists conducted survey interviews with consenting patients from October 2000 to December 2001. A follow-up interview was conducted 8-months on average after the initial survey.
RESULTS: A total of 143 patients (mean age 65.5 years ± SD 10.7) were prescribed 498 cardiovascular medications (mean no./patient 3.5 ± SD 1.5). The names of 25%, and the indications of 30% of the medications prescribed were not known. Patients' knowledge of their medication regimen was incorrect for 5% of the medications. One-third of the patients admitted to taking less medication than prescribed, mainly due to forgetfulness and adverse effects. Taking more of their medication than prescribed was acknowledged by 5% of patients, mainly because they felt they needed more. At follow-up, patients' (n=82) medication knowledge improved from a median score of 83% at the initial survey to 100% (p=0.000). Medication knowledge scores improved for 45% of the patients.
CONCLUSIONS: Community pharmacists were able to identify non-compliant patients and to improve patients' knowledge of their cardiovascular medications. Community pharmacists have the potential to improve the treatment of cardiovascular patients through medication review.

194. Rural Education and Drug Information (REDI) Program: strategies to optimize health care for patients at high risk for medication-related adverse events. *Charles T. Taylor, Pharm.D., BCPS*, Debbie C. Byrd, Pharm.D., BCPS, Kem Krueger, Pharm.D., Ph.D.; Auburn University, Auburn, AL.

BACKGROUND: Pharmaceutical care improves therapeutic documentation, prescribing appropriateness, patient compliance and health outcomes. However, data are limited regarding pharmacy services in rural, outpatient settings.
PURPOSE: To evaluate pharmacy services in rural, high-risk patients and to develop better understanding of factors associated with medication misadventures.
METHODS: Randomized, controlled trial of 69 patients identified as having a high risk for medication-related adverse events. The intervention included a complete pharmacotherapeutic review, chart review, medication history, and comprehensive, individualized patient education and monitoring over a one year period. Outcome measures were disease-related indicators, prescribing appropriateness, health-related quality of life, medication misadventures, patient satisfaction, and medication knowledge and adherence scores.
RESULTS: The number of treatment responders related to hypertension, diabetes, dyslipidemia, and anticoagulation increased significantly in the intervention group (increase 79%, 67%, 68%, and 75%, respectively). In contrast, treatment responders in the control group declined (decrease 3%, 30%, 10%, 30%, respectively). Inappropriate prescribing ratings improved in all medication appropriateness dimensions while the inappropriate ratings increased in five of ten dimensions for the control group. There were no significant differences between groups at closeout in health-related quality life. Also, medication misadventures in the intervention and control groups (2.8% and 3.0%, respectively) were similar (p=0.731). Other outcomes such as medication knowledge (increased 36% in intervention group, decreased 15% in control group) and number of prescribed medications were significantly different between groups at study conclusion.
CONCLUSIONS: Pharmacy services in rural, community-based settings can reduce inappropriate prescribing and enhance disease-state management while improving medication adherence and knowledge.

195. Diabetes quality improvement program through disease state management initiative in community pharmacies. *Stephanie F. Gardner, Pharm.D., Ed.D.*, Sharon Dickerson, R.N., B.S., CCM, PAHM, Mark Estes, Pharm.D., Susan Bumpas, R.N., CCM, Dee Moran, R.N.; University of Arkansas for Medical Sciences, Little Rock, AR.

PURPOSE: A partnership was formed between the UAMS College of Pharmacy and the State of Arkansas Employee Benefits Division to determine the effect of a community pharmacy based disease state management initiative for diabetic patients.
METHODS: 75 community pharmacists became credentialed in diabetes DSM. Study subjects with a diagnosis of DM were matched to community pharmacies based on zip code. Individual patient care plans were written for all patients with individual PCP approval at the initial visit. Up to ten additional visits occurred over a six to twelve month period. Outcome measurements (e.g., HbA_{1c}, blood pressure, lipid profile) were faxed to UAMS College of Pharmacy investigators every three months for data management. Evaluable patients completed a minimum of six months of DSM sessions. The project was funded by a restricted grant from Bristol-Myers Squibb.
RESULTS: 90 individuals have enrolled to date (12 complete, 33 actively enrolled, 45 drop-outs). Patients have dropped out secondary to physician refusal to participate (n=14) or because of a lack of commitment to finish the program (n=31). HbA_{1c} mean baseline levels were 8.8 mg% and dropped to an average of 7.65% (a difference of 1.15, p value of 0.03) in the 12 completed patients.
CONCLUSIONS: Preliminary data shows that a statewide, community pharmacy based disease state management initiative may be beneficial in improving the care of diabetic patients. Primary barriers have included physician participation and patient commitment to the program.

196. Pharmacotherapy assessment for new patients in a primary care clinic. *Elaine Lei, Pharm.D.*, Restie Crisologo, Pharm.D., Susan Hopp, M.D., Yong S.K. Moon, Pharm.D.; VA Long Beach Health Care System, Long Beach, CA; University of the Pacific, Stockton, CA.

PURPOSE: Many veterans are returning to the Veterans Affairs for prescription benefits due to increased drug cost. At VA Long Beach, it is difficult for the physicians to complete the initial visit effectively due to time limitation, frequent changes with the drug formulary or lack of documentation from these new patients. We proposed to have a pharmacist interview the new patients before their initial appointment with the physician.
METHODS: Our objectives are: 1) To collect patient demographics; 2) To educate patients about the pharmacy services; 3) To determine the impacts of pharmacist interventions on physician time, patient satisfaction and physician satisfaction. This was an eight-week pilot study. The patients were divided into 2 groups: intervention group and non-intervention group. Patients in the intervention group were interviewed by the pharmacist before their appointment with the physician. A progress note was documented for each encounter with recommendations regarding current therapy and formulary conversion. A survey was sent to all patients 2 weeks after the appointment.
RESULTS: Hypertension (21%), cardiovascular diseases (16%) and hyperlipidemia (9%) were among the top diagnosis. Approximately 50% of the medications were non-formulary agents. Statistically significant physician time was saved (3 minutes per patient; $p<0.05$). The pharmacist was able to obtain more complete drug allergy and over-the-counter drug history compared to the physician. The physician and patients were highly satisfied with pharmacist interventions.

CONCLUSIONS: This study demonstrated that it is beneficial to have a pharmacist interview new patients before their initial appointment with the physician.

197. Prevalence and characteristics of intravenous to oral conversion programs for anti-infectives in the United States. *N. R. Florea, Pharm.D.,* J. L. Kuti, Pharm.D., C. H. Nightingale, Ph.D., D. P. Nicolau, Pharm.D., FCCP; Hartford Hospital, Hartford, CT.

PURPOSE: Despite the success of anti-infective intravenous (IV) to oral (PO) conversion programs documented in the literature, it is still unclear what the current standard of practice is in U.S. hospitals. A survey was conducted to evaluate the prevalence and characteristics of conversion programs throughout the U.S.
METHODS: A questionnaire was mailed to 890 randomly chosen hospital pharmacy directors; 4 weeks were allowed for response.
RESULTS: A total of 237 (27%) institutions responded. Of these, 74% had conversion programs instituted. More programs required prior physician notification compared with allowing pharmacists to proactively transition candidates (70% versus 30%, $p<0.001$). The most common antibiotics converted were fluoroquinolones and fluconazole. Common conversion criteria included adequate PO intake and fever reduction. Characteristics associated with an increased likelihood of a conversion program were pharmacy residency programs (RR 1.3; 95%CI 1.132-1.477), clinical pharmacists (RR 1.6; 95% CI 1.262-2.123), ID specialty pharmacists (RR 1.3; 95% CI 1.153-1.499), ID physician consult service (RR 1.2; 95% CI 1.028-1.459), and teaching hospitals (RR 1.2; 95% CI 1.038-1.386). Hospitals with conversion programs employed a greater number of clinical pharmacists ($p=0.02$). Multivariate analysis revealed the presence of a clinical pharmacist was the most significant variable predicting implementation ($p<0.001$). Additionally, hospitals employing clinical pharmacists were more likely to allow pharmacists to proactively transition candidates (RR 1.3; 95% CI 1.027-1.533).
CONCLUSIONS: The majority of hospitals responding to this survey have an IV to PO conversion program in place. While most programs still require prior physician notification, the presence of clinical pharmacists significantly influenced the prevalence of implementation and proactive transition.

198. Evaluation of pharmacist-managed diabetes clinic in a private family medicine clinic. *Craig D. Logemann, Pharm.D.,* Laura K. Arensdorf, R.Ph., Patrick G. Jensen, Pharm.D.; Partners in Health Clinics, Des Moines, IA.

PURPOSE: To evaluate the outcomes in diabetic patients referred to Pharmacist managed clinic compared to those patients receiving continued care from their Physician.
METHODS: A chart audit was completed on 138 diabetic patients prior to Pharmacist initiating services at Family Medicine Clinic (June 2000-June 2001 data). Twenty-six of these patients were subsequently referred to Pharmacist for disease state management (FM-R.Ph. group). The remaining patients were followed by their Physician (FM-FM group, n=88) or lost to follow-up (n=24). A second chart audit was completed one year later (July 2001-July 2002 data) assessing Hemoglobin A_{1c} (HA_{1c}), blood pressures and lipid profiles. These results were compared to the Diabetes Provider Recognition Program (DPRP) threshold values.
RESULTS: The FM-R.Ph. patients were more likely to have HA_{1c} drawn during the second chart audit period compared to FM-FM patients (96% vs 91%; threshold > 93%) and more likely to have lipid profile drawn (73% vs 60%; threshold > 85%). The percent of patients with $HA_{1c} > 9.5\%$ decreased from 19% to 8% in the FM-R.Ph. group compared to change of 15 to 16% in FM-FM group (threshold < 21%). The percent of patients with BP < 140/90 mm Hg increased from 50 to 81% in FM-R.Ph. group compared to change of 76 to 73% in FM-FM group (threshold > 65%).
CONCLUSIONS: The Pharmacist met target thresholds for the Provider Recognition Program in majority of the categories evaluated. Pharmacists can provide interval monitoring of diabetic patients in a private practice setting to increase the overall quality of care.

199. Development and implementation of a screening process for patients receiving enoxaparin in a veterans affairs medical center population. *Karen J. Messmer, Pharm.D.,* Ellen M. Schellhase, Pharm.D.; Richard L. Roudebush VAMC, Indianapolis, IN; Purdue University, West Lafayette IN.

A retrospective review of 152 acute care patients who had received enoxaparin at the R.L. Roudebush VAMC, found 100 patients with renal dysfunction and/or obesity. This review validated the need for a hospital wide screening process for patients prescribed enoxaparin. A pharmacy driven protocol was then developed for screening patients receiving enoxaparin. The program was initially implemented in surgical patients. The surgical service clinical pharmacist was responsible for implementation of the pilot program. A computer-generated list of surgical patients receiving enoxaparin was printed daily. Patients were screened for renal dysfunction and/or obesity. Recommendations included medication alternatives or dosage adjustments. Patient specific factors, including indication and anticipated duration of therapy, were also considered when recommendations were made. Factor Xa monitoring is not available at this institution and therefore was not included in the recommendation protocol. Recommendations were made by verbal contact with the provider on daily rounds or by telephone. An assessment of this screening program will be performed before hospital-wide implementation. Data collection will include acceptance of recommendations and documentation of adverse events. After implementation of the pilot program, education will be provided to the entire pharmacy staff regarding the use of enoxaparin in special populations.

200. Lipid management in the primary care setting: pharmacy interventions in a veterans affairs medical center. *Ellen M. Schellhase, Pharm.D.,* Mark A. Deeg, M.D., Ph.D., Laura S. Michalski, Pharm.D., Deanna S. Kania, Pharm.D., BCPS; Purdue University, West Lafayette, IN; Roudebush VA Medical Center, Indianapolis, IN.

BACKGROUND: A retrospective review of Roudebush VAMC patients who met NCEP criteria for lipid lowering therapy demonstrated that less than 60% of patients were on treatment and less than 40% met their LDL goal.
PURPOSE: The purpose of this study was to determine the acceptance of pharmacy recommendations in patients with coronary disease and/or diabetes in a primary care clinic.
METHODS: An IRB approved, prospective trial was conducted within two clinics, one serving as the intervention group (n= 309; 157 on therapy and 152 not on therapy) and one as the control group (n=306 (156 on therapy and 150 not on therapy). A treatment algorithm was developed (based on NCEP guidelines) to provide standardized recommendations. In the intervention group, a clinical pharmacist placed written recommendations into patient charts before clinic visits. In the control group, no recommendations were made however standard physician treatment was compared to the proposed intervention by using the algorithm. A biostatistician validated study design and SAS 8.2 software was used for all analyses.
RESULTS: A total on 501 recommendations were made in the intervention group. Only 26% of recommendations focused on lipid treatment, the remaining were requests for lipid profile monitoring. When comparing the sub-group on therapy (control vs intervention), pharmacy recommendations were accepted (OR: 3.8; $p<0.001$). Pharmacy recommendations were also accepted when comparing the sub-group not on therapy (control vs intervention; OR: 2.2; $p=0.0005$). Follow-up data will be collected at 6 and 12 months to determine the effect of interventions on outcomes.
CONCLUSIONS: The study demonstrates the need for improved laboratory monitoring and lipid management. Pharmacy interventions did impact the treatment of patients. This data support the role of a clinical pharmacist in lipid management within a primary care clinic.

201. An assessment of sildenafil patient education in a Veterans Administration medical center. *Ellen M. Schellhase, Pharm.D.,* Tamara S. Evans, Pharm.D., BCPS, John Maul, Pharm.D. candidate; Purdue University, West Lafayette, IN; Pfizer, Indianapolis, IN.

PURPOSE: To determine if comprehensive patient education on the use of sildenafil was provided to patients receiving sildenafil prescriptions from a primary care clinic and to determine the medication knowledge level of these sildenafil recipients.
METHODS: A male pharmacy student administered a telephone survey to patients who were given new prescriptions for sildenafil. The survey included eight specific questions to assess patient knowledge related to sildenafil use. Patients were identified through a review of sildenafil non-formulary request forms over a three-month period. Patients were excluded if they did not receive the prescription from their primary care provider, had previously received sildenafil from an outside provider, or did not have a telephone. Patient demographics and prescription information were collected by medical record review.
RESULTS: One-hundred and seven patients qualified for the study. Three patients refused to participate. Only forty-five patients were available by telephone and therefore were included in the analysis. Thirty (66.7%) patients received sildenafil medication information. Of these patients, twenty-five (83%) felt that they were provided with adequate information. The majority [29 (96.7%)] of patients were informed of the administration timing when anticipating sexual intercourse. Few [6 (20%)] patients were informed that taking sildenafil after a high fat meal might cause the medication to take longer to begin working. Only three of these 30 patients (10%) were educated on each of the eight specific points related to sildenafil use.
CONCLUSIONS: Provision of comprehensive sildenafil medication information and subsequent patient knowledge on sildenafil use was low. Results will be used to promote the development of a pharmacy-driven protocol to provide comprehensive education to patients receiving sildenafil.

202. Pharmacy involvement with multidisciplinary stroke response team at a university teaching hospital. *P. Shane Winstead, Pharm.D.,* Kelly M. Smith, Pharm.D.; University of Kentucky Chandler Medical Center, Lexington, KY.

Alteplase is a recombinant tissue plasminogen activator (tPA) and was the first FDA approved therapy for treatment of acute ischemic stroke. After approval of this agent in June 1996, a pharmacist member was added to the multidisciplinary stroke response team at this university teaching hospital. The stroke team is activated when a patient presents to the emergency

department (ED) with signs or symptoms of stroke. Pharmacy residents participate in a 24-hour, in-house, on-call system. One responsibility of the Pharm.D. on call is to carry the stroke team pager and respond to each stroke alert. The role of the pharmacist is to screen patients for inclusion/exclusion criteria including time of onset of symptoms, risk of bleeding complications and hypertension. A hypertension management algorithm is used to make recommendations for treatment of high blood pressure and to determine if a patient is contraindicated for thrombolytic therapy. The pharmacist also educated the patient care nurse on correct dosing and administration of tPA. It has been reported that medication errors occur in up to 97% of patients given tPA for acute ischemic stroke. The goal of this service is to reduce medication errors that may result from this complicated medication regimen and to minimize adverse effects that can occur with use of thrombolytic therapy. From 01/01/2002 to 11/05/2002, the pharmacist participated the assessment of 10 patients; a total of 5 of these patients received thrombolytic therapy.

203. Getting your foot in the door without stepping on toes: from opportunity to collaborative practice. *Joy N. Evans, Pharm.D.,* Jennifer D. Goldman-Levine, Pharm.D.; Massachusetts College of Pharmacy and Health Sciences, Boston, MA.

PURPOSE: Many studies have demonstrated the broad range of pharmacist services, which enhance patient care, reduce costs and improve patient satisfaction. This report documents the development and delivery of a sample medication program as an entrance point for pharmacists to establish collaborative practice agreements in a state where they are currently prohibited.
METHODS: This endeavor begun by identifying the need of an ambulatory care practice in the area of improving storage, control and accountability of sample medications. Sample medications in Massachusetts must meet stringent regulations set by the Joint Commission of the Accreditation of Health Care Organizations. The clinic wanted to ensure all regulations were being followed and standards were being met. By identifying existing procedures for the storage, control and accountability of sample medications, the pharmacist formulated a new policy and procedure, and associated documents, which meet the standards. The pharmacist also created a prospective Drug Utilization Review (DUR) component of the sampling program, introducing the concept of pharmaceutical care and the potential for formation of collaborative practice in the future.
RESULTS: The new policy and procedure and documentation were reviewed by the medical director and will be implemented in the immediate future.
CONCLUSIONS: By developing this program, including prospective DUR, the pharmacist is able to build professional relationships within the clinic and document patient interventions. Through time this practice leads to trust and confidence in the ability of the pharmacist to positively impact patient outcomes and ultimately brings the profession a step closer to formal collaborative practice.

204. Clinical pharmacy impact on aspirin prescribing for primary and secondary prevention of cardiovascular disease. *Michael J. Gonyeau, B.S., Pharm.D., BCPS*; Northeastern University, Boston, MA.

PURPOSE: To evaluate the impact of pharmaceutical care on aspirin prescribing for primary and secondary prevention of cardiovascular disease in an urban, academic medical center.
METHODS: Data from a prospective 8-week intervention period were compared to baseline aspirin prescription rates during a 6-week prospective chart review. Medical histories and medications of patients admitted to select general medicine teams were reviewed and recommendations made per CHEST guidelines. The primary endpoint was discharge on aspirin or appropriate alternative. Secondary endpoints included influence of admitting diagnoses or cardiology consultation, acceptance of pharmacist recommendations and reasons for recommendation rejection.
RESULTS: 180 baseline and 255 intervention patients were assessed. The intervention group was 48% men, mean age 70, diabetes 29%, primary prevention (PP) candidates: 27%, secondary prevention (SP) candidates: 57%. All were similar to baseline except hypertension (58% vs 93%). At baseline, discharge aspirin (or appropriate alternative) use was 46% (PP) and 69% (SP). Intervention increased prescription by 33% (PP) (p=0.16) and 23% (SP) (p=0.0017). Aspirin was prescribed more often with cardiac admitting diagnoses (88% vs 58% p<0.0001). Cardiology consultation increased aspirin use (74 % vs 58% p=0.044). Recommendations were accepted in 41% and 59% of PP and SP candidates respectively. The most common recommendation rejection reason was assumed follow up by primary care physician (33%). Other reasons included concomitant alternative therapy (18%), and 25% unknown.
CONCLUSIONS: Pharmaceutical care increases aspirin prescribing upon discharge for primary and secondary prevention of CAD. Addressing the need for inpatient interventions on perceived outpatient issues may bridge the treatment gap.

205. A pharmacokinetic monitoring service in a community teaching hospital utilizing an interactive Microsoft Excel™ aminoglycoside first-dose order sheet. *Colby Allyn Thomas, Pharm.D.*; Sinai Hospital of Baltimore, Baltimore, MD.

PURPOSE: To describe and justify a pharmacy-based aminoglycoside dosing and monitoring service utilizing an interactive, computerized aminoglycoside first-dose ordering tool/automatic consult created as a Microsoft Excel™ form.
METHODS: The form was created to help physicians to 1) select the appropriate method of aminoglycoside therapy, 2) determine the loading dose and interval, 3) provide nursing with timing for serum sample analysis, 4) produce an automatic consult to the pharmacy-directed therapeutic drug monitoring (TDM) service, and 5) provide a clear, legible order. An audit of aminoglycoside use from January 1, 2001 to December 31, 2001 was completed to evaluate current practice. Indicators of aminoglycoside ordering and monitoring efficacy will be reevaluated once the pharmacy-directed service is implemented.
RESULTS: Forty charts were retrospectively audited. Based on current literature standards, the appropriate method and dose of aminoglycoside therapy was selected 55% and 57% of the time, respectively. Sub-therapeutic levels were documented in 46% of patients and the initial dose was sub-therapeutic in 77% of these patients. Supra-therapeutic levels were documented in 25% of patients. Of these patients, 71% had inappropriate intervals based on renal function. Fourteen percent of the patients achieved one peak or random once-daily level in the therapeutic range. The average time to achieve one therapeutic peak level was 64 hours.
CONCLUSIONS: The current prescribing and monitoring of aminoglycosides does not consistently provide patients with appropriate, therapeutic and timely therapy. Data is being collected to determine if an interactive tool/ automatic consult will provide improvements in aminoglycoside prescribing and monitoring.

206. Assessing an automatic renal dosing policy: validation of pharmacist competency. *Linda A. Browning, Pharm.D.,* Nikki Milan, Pharm.D., Krista Piekos, Pharm.D., Monica Sheih, Pharm.D., Kathy Pawlicki, M.S., FASHP; Harper University Hospital; Detroit Medical Center; Wayne State University, Detroit, MI.

PURPOSE: Initial prescribing practices often fail to consider the effects of renal insufficiency on medication elimination. Our institution implemented a renal dosing policy, and competency exam, which allows pharmacists the autonomy to dose adjust medications within specified guidelines. This project examines a validation tool to assess pharmacist competency, in accordance to JCAHO standards.
METHODS: We evaluated the appropriateness of pharmacist order-entry of medications based on renal function. Patients ≥ 60 years and/or patients with serum creatinine ≥ 1.5 mg/dl were targeted over a two week period. Creatinine clearance was calculated using the Cockroft-Gault method. Active medication orders were screened and compared to recommended dosages within the scope of the policy. Specific additional information regarding pharmacist initials, time of order entry, and patient care units were linked to the entry.
RESULTS: A total of 368 orders were reviewed of which 325 (88.3%) were deemed appropriate. Four medications comprised 70% of the orders that were entered outside our Renal Dosing Policy. Pharmacist adherence to the renal dosing policy ranged from 50 to 100%, with the lowest compliance rate occurring during the midnight shift. A quarter of all orders entered were prescribed from one particular patient care unit.
CONCLUSIONS: The goal of our department is to achieve and maintain a Renal Dosing Policy competency rate of at least a 90%. This review revealed that 88.3% of all renally eliminated medications were entered appropriately. We plan to continue to maintain the competency of our pharmacy staff through education initiatives and feedback of this data.

207. Developing and implementing an automatic renal dosage adjustment service. Teri Wooton, Pharm.D., *Andrew Barlow, Pharm.D.*; Northeast Medical Center, Concord, NC.

PURPOSE: This automated service was developed to establish a formalized, consistent approach to estimating creatinine clearance (CrCl) and adjusting medication doses.
METHODS: A list of 23 medications was compiled from the literature and manufacturer recommendations. This list, approved by P and T committee, is used by pharmacists to identify adult patients needing renal dose adjustment. Creatinine clearance is estimated with the Cockcroft-Gault equation using ideal body weight. If dose adjustment is warranted, an order is written, automatically changing the dose. Then, to evaluate the program's safety, a random sample of 50 interventions was chosen.
RESULTS: From March 2001 to September 2002, 1880 medication orders were adjusted using this protocol. Physicians objected to only twelve (0.64%) interventions. Medication classes included anti-infectives (66%), H_2 receptor antagonists (25%), and prokinetic agents (4%). Mean patient age is 76 years (20-100) with most being female (67%). Fewer adjustments were made on patients in critical care beds (26%). The safety evaluation revealed only three (6%) readmissions for a known infection after the initial anti-infective was

renally adjusted. Levofloxacin (2) and imipenem (1) were the initial anti-infectives adjusted for these readmissions.
CONCLUSIONS: In eighteen months, many general medicine patients have been identified whose medications required adjustment, thus reinforcing the need for this service. Physicians support the service and most overwhelmingly agree with the interventions. Automating this service may improve quality and decrease cost of patient care by early identification of those patients requiring dose adjustment.

208. Cherokee Indian Hospital coronary artery disease service. *Christopher C. Lamer, Pharm.D., CDE,* Cristen Smithmyer, Pharm.D.; Cherokee Indian Hospital, Cherokee, NC.

PURPOSE: The purpose of this novel outpatient based pharmacy service is to optimize the health care of Native Americans who have a diagnosis of coronary artery disease (CAD). This service will provide pharmaceutical care, patient education, and promote adherence to nationally accepted guidelines.
METHODS: A review of the Cherokee Indian Hospital patient information database reveals that among 13,154 people of Native American descent, 535 (4.1%) have a diagnosis of CAD. Of these 48.8% are currently receiving aspirin therapy, 34.3% receiving β-blocker therapy, 48.2% have a blood pressure < 130/80, and 47.7% are at or below goal LDL values of 100 mg/dl.
RESULTS: A pharmacy based CAD secondary prevention program has been designed and approved by the Pharmacy and Therapeutics Committee. The targeted population for this program will be patients who have established CAD. Six major outcomes will be evaluated at baseline and at the end of the study period. These shall include: (a) LDL goal of < 100, (b) BP goal < 130/80, (c) aspirin use, (d) β-blocker use, (e) ACEI use when appropriate, and (f) Hemoglobin A_{1c} when appropriate. All information will be collected by the pharmacist and documented in the patient's medical record.
CONCLUSIONS: The effectiveness of an outpatient pharmacy based CVD service will be evaluated in regards to the six major outcomes listed above and through a provider and patient satisfaction assessment. Final results will be submitted for publishing.

209. Initiation of a pharmacist-driven cardiovascular anticoagulation service in a community hospital setting. Mary Beth Bobek, Pharm.D., *Megan Rose, Pharm.D.*; New Hanover Regional Medical Center, Wilmington, NC.

PURPOSE: The purpose of this study was to evaluate the impact of a pharmacist run Cardiovascular Anticoagulation Service on patient outcomes for patients admitted for cardiovascular surgery in a community hospital.
METHODS: Medical records of patients admitted for cardiovascular surgery between January and March 2002 requiring post-op anticoagulation prior to the Anticoagulation Service were reviewed. Demographic information collected included sex, age, and past medical history, indication for anticoagulation, length of stay, number of days until therapeutic INR, heparin administration, and adverse outcomes. Adverse outcomes noted were development of DVT/PE, major bleed, CVA/TIA, MI, and any patient given either vitamin K or blood products for over-anticoagulation. The pharmacist-driven anticoagulation service was instituted on April 1, 2002 and concurrent data, the same as listed above, to date was collected.
RESULTS: Thirty-four patients pre-service and 30 post-service were reviewed, and demographic information was similar for each group. Average length of stay was reduced from 9.5 days to 7.6 days after the service began, the average number of days to reach a therapeutic INR declined from 8.08 days prior to the service to 3.23 days, and no patients were sub-therapeutic by the end of their home health coverage compared to 6 patients from the retrospective data. None of the patients in either group developed DVT/PE after initiation of anticoagulation, three patients (8.8%) in the pre-service group developed major bleeds while there were none in the concurrent group, and 2 patients (5.9%) in the pre-service group experienced a CVA/TIA compared to none in the concurrent group. Five patients (4.7%) and 7 patients (20.6%) received vitamin K and blood products, respectively, for over anticoagulation. Only one patient (3.3%) in the concurrent group required vitamin K and no blood products have been administered.
CONCLUSIONS: In a community hospital setting, a pharmacist run anticoagulation service has shown improvement in patient outcomes and time to therapeutic INR, and reduction in length of stay and bleeding events. Due to this data, a clinical pharmacist position was approved to continue providing this service.

210. Impact of issued prescriptions and/or written recommendations on pneumococcal vaccination rates among diabetic patients. *Mary Ann Halloran, Pharm.D., BCPS,* Mia M. Wirtjes, Pharm.D. candidate; University of Oklahoma, Oklahoma City, OK; Tinker Air Force Base, OK.

PURPOSE: Diabetic patients experience significantly increased morbidity and mortality due to pneumococcal pneumonia. In our pharmacist-managed diabetes consult clinic, recommending pneumococcal vaccination through progress notes yielded some improvement in immunization rates, but left a large group of patients unvaccinated. We implemented a plan for further intervention, consisting of providing patients with written prescriptions and continued placement of progress note recommendations for the primary care providers in the medical record.
METHODS: Clinic shadow files, medical records, and an immunization database were reviewed to capture baseline immunization status of diabetics enrolled in the clinic. Patients without documentation of previous pneumococcal vaccination were provided with a written recommendation for pneumococcal vaccine then issued a prescription to take to an on-site immunization clinic if the first intervention was unsuccessful. Baseline and post-intervention vaccination rates were calculated.
RESULTS: Three-hundred sixteen diabetic patients were consulted to the clinic, 289 patients before implementation of the prescription intervention and 27 patients added during the intervention period. Of the original 289 patients, 195 were unvaccinated, with 40 (20.5%) of these vaccinated following recommendations through progress notes. Of the 27 new referrals, 20 unvaccinated were added to the remaining 155 unvaccinated patients prime for more aggressive intervention. Prescriptions were provided to 48/175 patients in this group, 16 (33.3%) of whom obtained a pneumococcal vaccination.
CONCLUSIONS: While written prescriptions and progress note recommendations improved vaccination rates overall, future interventions must more aggressively target high-risk populations through a variety of methods to improve vaccination rates.

211E. The pharmaceutical care analysis project: a data collection project on pharmacists' impact, involving pharmacists monitoring patients with personal device assistants loaded with a pharmaceutical care program. *William McLean, Pharm.D.,* David U., B.Sc.Pharm., Carmine Stumpo, Pharm.D.; University of Ottawa, Ottawa, ON, Canada; ISMP Canada, Toronto, ON, Canada; Toronto East General Hospital, Toronto, ON, Canada.

Presented at the Annual Meeting of the Canadian Society of Hospital Pharmacists, Toronto, ON, Canada, February 1-4, 2003.

212. Impact of a new hospital policy to reduce risk for falls: the pharmacist's role. *Bob L. Lobo, Pharm.D., BCPS,* Wayne O. Carpenter, MBA, D.Ph.; Methodist Healthcare University Hospital, Memphis, TN.

PURPOSE: Our health-care system implemented a new policy to increase the identification of patients at risk for falls. The policy requires the pharmacist to evaluate patients who are placed on Fall Precautions for drug-induced fall risk. The pharmacist must write a note in the medical record describing the presence or absence of drug-induced fall risk. This study was designed to determine how often patients are placed on Fall Precautions, how often pharmacists document drug-induced fall risk and how much time is spent evaluating patients in accordance with the new policy.
METHODS: One month prior to data collection, pharmacists attended an inservice on drug-induced fall risk. Data on pharmacist evaluations was collected by chart review over one week. Patients on Fall Precautions were identified by hospital computer printout.
RESULTS: Out of 130 patients admitted during a random 2-day period, 48 were placed on Fall Precautions (37% of all admits). Pharmacists documented having evaluated 3 of the 48 patients (6%) for drug-induced fall risk during the week that followed admission. Average time to complete an evaluation was 15 minutes.
CONCLUSIONS: If an average of 24 patients are placed on Fall Precautions per day, it would require 6 hours per day (24 patients X 15 minutes) of pharmacists time to evaluate all patients at risk. If all patients who are placed on Fall Precautions are to be evaluated by a pharmacist, it may require an additional FTE to ensure compliance with the new policy.

213. The development and implementation of a multidisciplinary antibiotic review team. *Gregory T. Matsuura, Pharm.D.,* Angela Stewart, Pharm.D., BCPS; Yakima Valley Memorial Hospital, Yakima, WA.

PURPOSE: The purpose of this study was to implement an antibiotic review team (ART) and evaluate its impact in a community hospital setting.
METHODS: Data was collected over a 45-day period. In-patients started on IV antibiotics were included and this observational baseline data was presented to the major hospital physician. During a 2nd interventional period, prescribers were contacted with ART recommendations. Results of these interventions were analyzed and compared to baseline data. Patient cases for both periods were reviewed by an infectious disease physician along with the ART pharmacist.
RESULTS: One hundred and eleven patients were reviewed over the 45 day baseline period. Twenty seven (24.3%) cases were identified in which antibiotic therapy could have been optimized. The 3 most common antibiotic prescribing problems were: 1) Too broad antibiotic spectrum (33%), 2) inappropriate drug dosing (22%), and 3) redundant antibiotic therapy (22%). During the 3 month interventional period, 181 patients were screened through the active ART process. Over this time frame, 17 (9.4%) ART recommendations were implemented by prescribers. These interventions resulted in either a change in dose (23.5%), alteration in antibiotic selection (35.3%), discontinuation of antibiotic (23.5%), and selection of initial antibiotic therapy (11.7%).
CONCLUSIONS: The ART program has produced limited success in improving patient outcomes. Several factors were noted to contribute to reduced numbers of accepted recommendations. Physician acceptance and pharmacist work load limitations were major areas for improvements. This

information will be presented to administration to increase support for the service.

214. Impact of telephone versus in-person follow-up on patient satisfaction with anticoagulation monitoring in a pharmacist-managed anticoagulation clinic program. *Ellen E. Rhinard, Pharm.D.,* Ann Wittkowsky, Pharm.D., CACP; University of Washington Medical Center, Seattle, WA.

PURPOSE: This survey evaluated satisfaction in ambulatory anticoagulation patients managed by telephone compared with patients managed through in-person office drop-in visits.
METHODS: Anonymous, return postage-paid surveys and follow-up reminder postcards were mailed to all active patients at four pharmacist-run anticoagulation clinics at a university-based medical center. Questions addressed overall satisfaction with the service as well as satisfaction with quality, convenience, and safety of monitoring. Question scores ranged from "very dissatisfied" through "dissatisfied," "satisfied," and "very satisfied" to "extremely satisfied."
RESULTS: Sixty percent (408) of the surveys were returned. One-third of respondents (134) indicated follow-up of their prothrombin time results was always or almost always conducted by telephone, and 46% (189) indicated they always or almost always visited the pharmacists in person. Despite a trend toward greater satisfaction scores with in-person visits, no significant differences were noted between these groups or between these groups and patients who used both forms of follow-up. Regarding overall satisfaction with care, 51% of the phone management group, 61% of the office visit group, and 57% of the entire group reported they were extremely satisfied; 92% of the phone group, 98% of the visit group, and 95% of the entire group chose positive satisfaction scores.
CONCLUSIONS: Respondents did not decisively favor office visits versus telephone follow-up. This information, together with clinical outcomes associated with different contact methods, builds a case that pharmacists should be reimbursed for anticoagulation management provided by telephone as well as for in-person office visits.

215. Interim analysis of the clinical and financial impact of a pharmacist-managed asthma/COPD clinic in a county teaching hospital. *Allen Shek, Pharm.D.,* Veronica Bandy, Pharm.D.; University of the Pacific, Stockton, CA.

PURPOSE: The objective of this study is to assess the clinical and financial impact of a pharmacist-managed Asthma/COPD Clinic at San Joaquin General Hospital (SJGH).
METHODS: Medical records of all adult asthma patients referred to the Pharmacist-managed Asthma/COPD Clinic between September 1999 and March 2001 were reviewed.
RESULTS: A total of 39 patients with complete records were included in the interim analysis. The average follow up was 10.4 months (3.3-17.1). At enrollment, only 25% patients demonstrated correct MDI technique, 13% had or were using a spacer, 10% had a peak flow meter, and 10% had an action plan. Only 23% of patients were on appropriate medication regimen according to the NIH guidelines. The average asthma severity at enrollment was 3.4, and 3.0 at the end of study period. One year prior to enrollment there were 50 ER visits (1.28 ER visits/patient-year) and 14 hospitalizations (0.36 hospitalizations/patient-year) secondary to asthma exacerbations. During the follow-up period, the same cohort of patients had 18 ER visits (0.53 ER visits/patient-year) and 3 hospitalizations (0.089 hospitalizations/patient-year.)
CONCLUSIONS: Pharmacist intervention (intense education and medication optimization) resulted in a 59% reduction in ER visits and a 75% reduction in hospitalizations secondary to asthma exacerbation. We postulate that if the clinic population were expanded to manage 100 high risk patients who have at least 2 hospital admissions per year, at least $2.7 million hospital charges could be averted, which would save SJGH $1.8 million in "full cost" per year.

216. Pharmacist-managed smoking cessation program for the underserved population: an evolving process. *Karen L. Steinmetz, Pharm.D.,* Mary I. Herbert, M.S.; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: This project documents the evolution of an innovative smoking cessation program serving primarily medically indigent individuals.
METHODS: Based upon results from a previously performed needs assessment of the underserved population, a free comprehensive smoking cessation program was initiated in December 2001. The program combined individual behavior modification with transdermal nicotine replacement therapy over an eight-week period. The objectives of the initial patient encounter were to obtain a patient assessment and distribute the first week supply of patches. The patient assessment included an evaluation of readiness to quit, barriers, reasons and concerns about quitting, and self-reported stage of change, with coronary artery disease and diabetes risk assessments. Follow-up visits recorded self-reported progress and/or problems encountered. During the first seven months, 60 patients were enrolled, 30% of which did not return after the initial visit, and 37% successfully completing the program. In June 2002, the staff evaluated mechanisms to improve patient's continued participation in the program to improve success rates and to enhance cost-effectiveness from the program's perspective. Implemented changes include an expanded initial assessment on the first patient encounter, with nicotine patches distributed at subsequent visits. The expanded assessment includes a nicotine dependence and motivation measurement, a patient contract outlining the program policies, and a thorough medical history. Additionally, calls to patients have been initiated to document continued success at routine intervals.
CONCLUSIONS: Efforts to evaluate the benefits of smoking cessation in this population are on going. Providing quality health care to the underserved population remains the highest priority.

217. The impact of pharmacist interventions in osteoporosis prevention. *Sarah V. Muench, Pharm.D.,* Laura A. Katz, Pharm.D.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

INTRODUCTION: Approximately 30% of post-menopausal women in the United States have osteoporosis, and an additional 54% have osteopenia. It is estimated that less than one-third of these cases are diagnosed, and only one-seventh receive treatment.
PURPOSE: The purpose of this study was to determine if a pharmacist could positively impact the percentage of patients in an outpatient clinic receiving appropriate osteoporosis prevention therapy.
METHODS: This was a five-month two-phase study. Phase I was a retrospective review of 100 sequentially selected charts. Charts were evaluated using criteria derived from osteoporosis guidelines to determine the osteoporosis prevention rate (OPR). The OPR was defined as the percentage of patients receiving appropriate preventative therapy. The criteria included assessment of patient risk factors, calcium intake, diagnostic procedures and lifestyle modifications. Phase II was a prospective intervention and chart review period. Pharmacists met with physicians to review osteoporosis guidelines, pharmacologic therapy and dietary supplements. Pharmacists screened charts to identify patients at risk and suggested preventative therapy when appropriate. At the conclusion of Phase II, 100 charts were evaluated according to the same criteria used in Phase I. The OPR was compared between Phase I and II using the Chi-squared test.
RESULTS: The OPR in Phase I and II were 23% and 46% respectively (p=0.001). The number of patients receiving the appropriate amount of calcium increased from 27% in Phase I to 50% in Phase II (p=0.001). Appropriate bone mineral density testing was ordered in 21.8% patients in Phase I vs 42.8% in Phase II, (p=0.008).
CONCLUSIONS: A greater OPR was seen after pharmacist intervention. From these results clinic pharmacists will continue to evaluate patients at risk for developing osteoporosis.

Student, Resident, Fellow Research in Progress

These papers describe original research by students, residents, and fellows in therapeutics, pharmacokinetics, pharmacodynamics, pharmacoeconomics, and pharmacoepidemiology 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.

218. Analysis of dispensing error reports for the Central Arkansas Veteran's Healthcare System from October 1997 through September 2001. *Philip Rolland, M.Ed., Pharm.D., B.S.*; Central Arkansas Veteran's Healthcare System, Little Rock, AR.

219. Warfarin medication interactions documented in an Indian health service pharmacy-based anticoagulation management service. *Lori J. Alred, Pharm.D.*; Claremore Indian Hospital, Claremore, OK.

220. Management of advanced renal failure patients who experiences elevated troponin levels. *Janice Pui Hang Tam, Pharm.D.,* Craig D. Williams, Pharm.D.; Purdue University, West Lafayette, IN.

221. Impact of pharmacist intervention on LDL-C goal attainment in diabetic patients taking statins in family practice and internal medicine clinics. *Sheila L. Kasten, Pharm.D.,* Teresa B. Klepser, Pharm.D., Rick W. Dettloff, Pharm.D., BCPS, Mitzi M. µginnis, Pharm.D., Steve W. Durst, Pharm.D., BCPS, Richard L. Cook, Pharm.D.; Ferris State University, Kalamazoo, MI; Pfizer, Grand Rapids, MI; Blue Care Network, Grand Rapids, MI.

222. Enoxaparin as bridge-out therapy for cardiovascular indications. *Trupti P. Mehta, Pharm.D.,* Alison Tran, Pharm.D., Aungkana Vichiendilokkul, Pharm.D., M.S., Eric Racine, Pharm.D.; Wayne State University, Detroit, MI.

223. Evaluation of hypothyroidism in chronic heart failure. *Sarah C. Middleton, Pharm.D.,* Anne P. Spencer, Pharm.D., BCPS; Medical University of South Carolina, Charleston, SC.

224. Enoxaparin provides a feasible alternative to an unfractionated heparin nomogram. *Kamila A. Dell, Pharm.D.,* Michelle M. Wheeler, Pharm.D., Brian C. Barker, R.Ph.; University of Utah Hospitals and Clinics, Salt Lake City, UT.

225. Comparison of hemodynamic effects of continuous infusions of

pancuronium and cisatracurium. *Kimberly A. Corpus, Pharm.D.,* Christopher Zimmerman, Pharm.D., Michael Peters, R.Ph, Mark Mlynarek, R.Ph.; Henry Ford Hospital, Detroit, MI.

226E. Introducing hypertonic saline for cerebral edema: an academic center experience. *Lisa L. Larive, Pharm.D.,* Denise H. Rhoney, Pharm.D., Dennis Parker, Jr., Pharm.D., William M. Coplin, M.D., J. Ricardo Carhuapoma, M.D.; Wayne State University, Detroit, MI.

227. Evaluation of a magnesium replacement protocol in the medical intensive care unit. *Lindsay J. Pell, Pharm.D.,* Mary Beth Shirk, Pharm.D., Brenda K. Hixon-Vermillion, BSN, Stephen P. Hoffmann, M.D.; Ohio State University Medical Center, Columbus, OH.

228. HIPAA implementation model for consumer-based drug information practice. *Maisha Kelly, Pharm.D.,* Rachel A. Bongiorno, Pharm.D.; University of Maryland, Baltimore, MD.

229. The impact of the Health Insurance Portability and Accountability Act on drug information practice. *Maisha Kelly, Pharm.D.,* Rachel A. Bongiorno, Pharm.D.; University of Maryland, Baltimore, MD.

230. The occurrence of new onset diabetes mellitus with single and concurrent atypical antipsychotic therapy. *Carie D. Hatch, Pharm.D.,* Rex W. Force, Pharm.D., FCCP, BCPS, Julie M. Wilkinson, Pharm.D., Paul S. Cady, Ph.D., Vaughn L. Culbertson, Pharm.D.; Idaho State University College of Pharmacy, Pocatello, ID.

231. Effect of a combination ephedra-containing supplement on cardiac rhythm. *Amy M. Franks, Pharm.D.,* Stephanie F. Gardner, Pharm.D., Ed.D, Bill J. Gurley, Ph.D., B.K. Singh, M.D., Jawahar L. Mehta, M.D.; University of Arkansas for Medical Sciences, Little Rock, AR.

232. Meta-analysis of natural therapies for hyperlipidemia: policosanol vs plant stanol esters. *Judy T. Chen, Pharm.D.,* Gyorgy Csako, M.D., Robert Wesley, Ph.D., Frank Pucino, Pharm.D.; National Institutes of Health, Bethesda, MD.

233. Pharmacodynamics of continuous infusion cefepime in adult cystic fibrosis patients. *Emily E. Han, Pharm.D.,* Paul M. Beringer, Pharm.D., Stan Louie, Pharm.D., Ph.D., Bertrand Shapiro, M.D., Mark Gill, Pharm.D.; University of Southern California, Los Angeles, CA.

234. Linezolid use in surgery patients: a focus on thrombocytopenia incidence and prevention. *Jack Brown, Pharm.D.,* Debra A. Goff, Pharm.D.; Ohio State University Medical Center, Columbus, OH.

235. Effects of atorvastatin on low-density lipoprotein phenotype and C-reactive protein in chronic hemodialysis patients. *Kimberly A. Dornbrook-Lavender, Pharm.D.,* Melanie S. Joy, Pharm.D., John A. Pieper, Pharm.D., BCPS, FCCP; University of North Carolina, Chapel Hill, NC; University of New Mexico, Albuquerque, NM.

236. Comparison of the efficacy of oral calcitriol versus oral alfacalcidol in the treatment of secondary hyperparathyroidism. *Samantha S. Moe, B.Sc.Pharm.,* Lori D. Wazny, Pharm.D., Janet E. Martin, Pharm.D.; St. Michael's Hospital, Toronto, ON, Canada; London Health Sciences Center, London, ON, Canada.

237. Evaluation of the impact of pharmacist intervention on adherence to an anemia treatment algorithm in cancer patients. *Daniel Bestul, Pharm.D.,* Cindy O'Bryant, Pharm.D., BCOP, Marianne McCollum, Ph.D., R.Ph., BCPS; University of Colorado, Denver, CO.

238. Plasma and tumor disposition of platinum analogues in xenograft models of melanoma and in patients with metastatic melanoma. *Laura L. Jung, Pharm.D.,* Julie Eiseman, Ph.D., Markus Muller, M.D., Martin Brunner, M.D., Erin Joseph, M.S., Merrill J. Egorin, M.D., William C. Zamboni, Pharm.D.; University of Pittsburgh, Pittsburgh, PA; Vienna University Hospital, Vienna, Austria.

239. In vitro evaluation and optimization of taxane and platinum combination treatment in panel of human ovarian cancer cell lines. *Hop Ngo,* Shi Nan Wang, M.D., Ph.D., Jodi Wojdylo, Pharm.D., Judith A. Smith, Pharm.D., BCOP; M.D. Anderson Cancer Center, Houston, TX.

240. A Medicaid prior authorization program: the use and cost of antihistamines and nasal steroids. *Barbara L. Novak, Pharm.D.,* Paul Cady, Ph.D., Rex Force Pharm.D.; Idaho State University, Pocatello, ID.

241. Evaluation of patient compliance with written asthma action plans in a pharmacist-manages asthma clinic. *C. LeAnn Causey, Pharm.D.,* Leigh Ann Ramsey, Pharm.D.; University of Mississippi, Jackson, MS.

242. Implementation and evaluation of an alcohol withdrawal syndrome practice guideline in a general medicine patient population. *Suzanne C. Berkman, Pharm.D.,* Karen M. Stanley, M.S., APRN, B.C., Anne P. Spencer, Pharm.D., Marlea Givens, Pharm.D., Kit N. Simpson, Dr.PH., Cathy L. Worrall, BSN, R.N., Pharm.D.; Medical University of South Carolina, Charleston, SC.

243E. Increased toxicity of azathioprine in renal transplant patients expressing TPMT*2, 3A, 3C. *Christine M. Formea, Pharm.D.,* Heather Myers, B.S., Tuan Luu, B.S., Son Nguyen, B.S., Edith St. Pierre, Pharm.D., Ken Smoot, P.A., Janet Crabtree, P.A., Alan Hemming, M.D., Willem Van Der Werf, M.D., Alan Reed, M.D., Shiro Fujita, M.D., Richard Howard, M.D., Ph.D., Janet L. Karlix, Pharm.D.; University of Florida, Gainesville, FL.

Presented at the 2002 Fellows' Conference: Advances in Organ Transplantation, Dallas, TX, March 14-17, 2002.

244. Use of survival analysis to evaluate duration of hormone replacement therapy: influence of mega-trials and guidelines. *Nicole Murdock,* Rex W. Force, Pharm.D., BCPS, FCCP, Julie Johnson-Wilkinson, Pharm.D., Paul S. Cady, Ph.D.; Idaho State University, Pocatello, ID.

245. The use of community bone mineral density screenings to identify and educate patients with osteoporosis. *Kelly M. Summers, Pharm.D. candidate,* Tina Penick Brock, M.S.; University of North Carolina, Chapel Hill, NC.

246. Utilization of lipid-lowering therapy following ST segment elevation acute myocardial infarction. *Nicole L. Schlobohm, Pharm.D.,* Marianne McCollum, Ph.D., Kathleen A. Stringer, Pharm.D., Joseph J. Saseen, Pharm.D., J.E.B. Burchenal, M.D.; University of Colorado Hospital; University of Colorado Health Sciences Center, Denver, CO.

Research Institute

The following papers, based on Fellowships and Research Awards provided by the ACCP Research Institute, will be presented. Full titles and authors are listed, although a complete abstract may not be available for all papers at the time of this printing.

247. Aventis Oncology Fellowship: Plasma and tumor disposition of platinum analogues in xenograft models of melanoma and in patients with metastatic melanoma. *Laura L. Jung, Pharm.D.,* Julie Eiseman Ph.D., Markus Muller, M.D., Martin Brunner, M.D., Erin Joseph, M.S., Sanjiv Agarwala, M.D., John Kirkwood, M.D., Merrill J. Egorin, M.D., William C. Zamboni, Pharm.D.; University of Pittsburgh Cancer Institute, Pittsburgh, PA; University of Pittsburgh, Pittsburgh, PA; Vienna University Hospital, Vienna, Austria.

PURPOSE: Inherent differences in tumor vascularity, capillary permeability, and/or tumor interstitial pressure can result in variable delivery of anticancer agents to tumors and affect antitumor responses. Thus, we evaluated the plasma and tumor deposition of platinum (Pt) analogues in preclinical models and in patients.
METHODS: Plasma and tumor extracellular fluid (ECF) deposition, as measured by microdialysis, were performed in mice bearing B16 murine melanoma tumors and in patients with metastatic melanoma. Mice received either cisplatin 10 mg/kg IV x 1 or carboplatin 60 mg/kg IV x 1. Patients received either cisplatin 20 mg/m^2 IV x 1 or carboplatin 400 mg/m^2 IV x 1. Serial blood samples and tumor ECF samples were obtained in mice and patients. Due to limited sample volume, separate mice were used for pharmacokinetic and microdialysis studies. Unbound and total Pt plasma and tumor ECF samples were analyzed by flameless atomic absorption spectrometry. Area under the plasma and tumor ECF concentration versus time profiles (AUC) were calculated by compartmental modeling.
RESULTS: After administration of cisplatin in mice, the unbound Pt AUC in plasma and tumor ECF were 3.9 and 0.6 ± 0.5 µg/ml•hr, respectively. Mean ± SD Pt exposures in ECF of murine melanoma tumors were 25 ± 12% of plasma Pt exposure. After administration of cisplatin in patients, the mean ± SD unbound Pt AUC in plasma was 1.2 ± 0.4 µg/ml•hr. Microdialysis studies of tumor ECF disposition of cisplatin were not performed due to a lack of patients with accessible tumors. After administration of carboplatin in patients, the Pt exposures in ECF of subcutaneous melanoma tumors were 50 to 60% of plasma exposures. Microdialysis studies of carboplatin in mice bearing B16 murine melanoma tumors are underway.
CONCLUSIONS: This preliminary data suggests the penetration of Pt analogues into tumor ECF is different in mice and humans. Thus, xenografts may not be an appropriate model of tumor penetration and efficacy.

248. Bayer Critical Care Fellowship: The effect of intensive glucose control on the incidence of infection in critically ill patients receiving parenteral nutrition. *Eric Sahloff, Pharm.D.,* Steven Martin, Pharm.D., BCPS, FCCM, Martin Ohlinger, Pharm.D., BCPS, Milo Engoren, M.D.; University of Toledo; St. Vincent Mercy Medical Center, Toledo, OH.

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