ABSTRACTS

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American College of Clinical Pharmacy
2000 Spring Practice and Research Forum
April 2–5 ▪ 2000
DoubleTree Hotel
Monterey Convention Center
Monterey ▪ California

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ORIGINAL RESEARCH

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

Adverse Drug Reactions/Drug Interactions

1. Knowledge and beliefs about adverse drug event reporting in residents and interns early in their career. *Sonja Kaubisch, Pharm.D.*, Clifford Wang, M.D., MPH.; Santa Clara Valley Health and Hospital System, San Jose, CA.

PURPOSE: To assess the knowledge and beliefs of residents and interns early in their careers about adverse drug event (ADE) reporting to identify areas for improvement.
METHODS: The survey tool incorporated questions assessing possible common beliefs and knowledge/understanding regarding ADE reporting. Overall responses between residents and interns were evaluated.
RESULTS: Response rate was 75.9% (48/62 surveys returned). Preliminary analysis showed a respondents' decision to report an ADE included understanding the importance of reporting ADEs (96%), belief in professional obligation to report ADEs (87.5%), belief that they did not directly cause harm to the patient (92%), and belief that quality of patient care would improve (56%). Primary reasons for not reporting an ADE included lack of knowledge about what to report (81%), excessive paperwork (67%), unclear cause and effect associated with the ADE (50%). Incomplete information deterred 48%, and questionable utilization of the ADEs reported deterred 50% of the respondents. Physician confidentiality concerned 42% respondents, was of no concern to 33% respondents, and 25% respondents were uncommitted. χ^2 analysis demonstrated significant difference only in belief of direct responsibility for patient harm (interns > residents; p=0.0043).
CONCLUSION: Obstacles to reporting ADEs included how or what to report and ease of reporting. Creating a user-friendly system and establishing "no-fault" sentiment should improve reporting rates. Further analysis will include comparing knowledge and beliefs between residents/interns and attending physicians.

2. Description and prevalence of adverse drug reactions in the general population: a focus on an outpatient pharmacy setting. *Gamal Hussein, Pharm.D.*, Keith Harrigan, B.S., Mary Gauthier-Lewis, Pharm.D., John Bull, B.S.; University of Louisiana, Monroe, LA; Pharmerica at Touro Infirmary, New Orleans, LA.

PURPOSE: Adverse drug reactions (ADRs) represent an important health care problem. Currently there is no information available on the frequency and consequences of ADRs in the outpatient setting. This study will 1) estimate the prevalence of ADRs in the outpatient population; 2) identify the drugs most commonly cited for causing the reactions; 3) evaluate patient outcomes; and 4) identify means to improve patient care.
METHODS: A survey was developed and tested to capture and evaluate ADRs among outpatients. The survey addressed the following topics: patient age, sex, race and disease states; reaction descriptions and actions taken upon its discovery; and outcomes of the reactions.
RESULTS: Out of 103 patients interviewed, 52 (50.5%) reported an adverse reaction. A total of 86 reactions were reported; 70 (81.4%) occurred in the outpatient setting after taking a medication dispensed by a retail pharmacy. Based on preliminary data, the prevalence of ADRs in the general public is now estimated to be 51%. Of the reported reactions, 11% were classified as serious (life threatening), 14% lead emergency room visits, 2% lead to hospital admissions, 11% lead to physician office visits, and 44% lead to calling a primary health care provider.
CONCLUSION: Despite the small scale of this study and the bias of the sample location, this study has revealed significant and valuable data about ADRs and their prevalence in community pharmacy. This research not only demonstrates a need for additional preventative measures, but also a need for expanded pharmacy services.

3. Dihydropyridine-type calcium channel blocker-induced angioedema. *Mitchell Nazario, Pharm.D.*, Sylvette Nazario, M.D.; San Juan Department of Veterans Affairs Medical Center, San Juan, Puerto Rico.

PURPOSE: To evaluate the occurrence of angioedema induced by dihydropyridine-type calcium channel blockers (CCB) in three patients at the San Juan Department of Veterans Affairs Medical Center (SJVAMC).
METHODS: Three cases of dihydropyridine-type CCB-induced angioedema were reported at the SJVAMC. Two of the cases were the result of an accidental CCB overdose where patients switched from amlodipine to felodipine mistakenly took both drugs simultaneously. All cases were characterized by swelling of the lips, mouth and tongue. Concomitant swelling of the vocal cords and epiglottis occurred in two cases, one of which required intubation for respiratory failure. The cases were evaluated following SJVAMC and FDA adverse drug event reporting and monitoring guidelines; Naranjo testing was performed for probability assessment.
RESULTS: Angioedema is not a readily recognized CCB adverse effect yet medical evaluation of three cases at the SJVAMC led to the diagnosis of CCB-induced angioedema. Case evaluation revealed a positive temporal relationship to drug administration and resolution of the effect upon discontinuation of the CCB. Naranjo testing scored the reactions as probably related to the CCB. The reactions were classified as significant as per FDA criteria.
CONCLUSION: Angioedema is an adverse drug reaction that may be induced by CCBs. Accidental overdosing of CCBs may increase the likelihood and severity of this reaction.

4E. Antibiotic-induced neutropenia in patients receiving community-based parenteral anti-infective therapy: piperacillin/tazobactam versus ticarcillin/clavulanate. *Morton P. Goldman, Pharm.D.*, Susan J. Rehm, M.D.; The Cleveland Clinic Foundation, Cleveland, OH.

Presented at the 37th Annual Meeting of the Infectious Diseases Society of America, Philadelphia, PA, November 19, 1999.

5E. Safety and tolerance of linezolid in phase II trials. Nancy E. Wilks, R.N., M.P.H., Maureen A. McConnell-Martin, M.S., Thomas H. Oliphant, Ph.D., Donald H. Batts, M.D., *Sue Cammarata, M.D.*; Pharmacia and Upjohn, Kalamazoo, MI.

Presented at the 39th Interscience Conference on Antimicrobial Agents and Chemotherapy of the American Society for Microbiology, San Francisco, CA, September, 1999.

6. Lipid changes with troglitazone therapy in atorvastatin-treated patients. *Aileen Bown Luzier, Pharm.D.*, Angela Wisniewski, Pharm.D., Lisanne DiTusa, Pharm.D., Sheryl L. Chow, B.S., Brian D. Snyder, M.D.; State University of New York, Buffalo, NY; Promedicus Health Group, West Seneca, NY.

Troglitazone is a CYP 3A4 isoenzyme inducer known to decrease the plasma concentration of drugs metabolized by CYP 3A4. Atorvastatin, a known substrate of the CYP 3A4 pathway, is often used in combination with troglitazone for diabetic patients with dyslipidemia. Currently, there are no documented studies that focus on the interaction between troglitazone and atorvastatin.
PURPOSE: We examined the effect of troglitazone on fasting lipid profiles (FLP) and hemoglobin (Hb) A_{1C} levels in patents treated with atorvastatin.
METHODS: We reviewed the medical records of patients who received concomitant troglitazone and atorvastatin therapy. Patients were included in the analysis if 1) complete laboratory data (FLP, HbA_{1C}) was available during treatment with atorvastatin alone and during treatment with the combination of atorvastatin and troglitazone; 2) the dose of atorvastatin remained unchanged; and 3) adherence with medications. Data collected included demographics, laboratory data, medications and treatment course.
RESULTS: Overall, we identified 31 patients that received troglitazone/atorvastatin combination therapy. Of those, seven (23%) patients met the inclusion criteria. All of the patients were male, mean age 59 years. Average laboratory changes were as follows:

	Fasting Lipid Profile (mg/dl)				HbA_{1C} %
	Total Cholesterol	LDL	HDL	Triglycerides	
Atorvastatin alone	227	109	40	307	10.5
Atorvastatin plus troglitazone	230	133	41	390	9.8
Change (mean)	+2	+24*	+1	+83	0.7

* p=0.03

CONCLUSION: The increase in LDL on atorvastatin/troglitazone combination therapy compared with atorvastatin alone is suggestive of a drug interaction. Further studies involving troglitazone and atorvastatin may be warranted to substantiate this interaction.

Cardiology

7. Meta-analysis of the antiarrhythmic effects of prophylactic sotalol following cardiac surgery. *Paul E. Nolan, Jr., Pharm.D.*, James E. Tisdale, Pharm.D., Sarah A. Spinler, Pharm.D., Daniel E. Hilleman, Pharm.D., Marion K. Slack, Ph.D.; University of Arizona, Tucson, AZ; Wayne State University, Detroit, MI; Philadelphia College of Pharmacy, Philadelphia, PA; Creighton University, Omaha, NE.

PURPOSE: Atrial fibrillation (AF) following cardiac surgery (CS) is common and may contribute both to increased post-CS morbidity and length of stay (LOS). Prophylactic sotalol (SO) has been used to decrease post-CS AF. However, the small size of these studies may limit the generalizability of their findings. Therefore, the purpose of this study was to use meta-analysis to better assess the effect of prophylactic SO in preventing post-CS AF.
METHODS: Four prospective, randomized, controlled studies comparing SO (n=341) vs placebo (PL; n=355) were aggregated using standard meta-analytic techniques. Odds ratio and 95% confidence intervals were calculated for post-CS AF.
RESULTS: The groups did not differ with respect to age, gender, pre-CS beta-blocker use, aortic cross-clamp time, number of coronary artery bypass anastomoses, or need for aortic valve replacement. Nearly all patients in each group had a left ventricular ejection fraction ≥ 30%. Post-CS AF was significantly decreased from 31% to 16% by SO (OR: 0.5; CI: 0.31-0.65; p=0.001). Although AF event rates were similar in the control groups (28% to 38%), the relative risk reduction ratios by SO varied substantially among studies (29% to 93%). Only two studies reported LOS results; and LOS was reduced 4% in one study and 15% in the other. Adverse effects necessitating withdrawal of treatment were not different between groups. There was one death in the placebo group.
CONCLUSION: SO decreases post-CS AF in patients with reasonably preserved or normal left ventricular function. Prophylactic SO may slightly reduce LOS.

8. Validation of reliability for two home blood pressure monitoring devices. *Daniel J. G. Thirion, Pharm.D., M.Sc.*, Laura A. Katz, Pharm.D.; Columbus Regional, Columbus, OH; William Beaumont Hospital, Royal Oak, MI.

PURPOSE: To compare two home blood pressure monitoring devices to the standard mercury sphygmomanometer for determination of reliability in systolic (SBP) and diastolic blood pressure (DBP) readings.
METHODS: The OMRON HEM-412C and Lumiscope 1085-M were compared to a mercury sphygmomanometer based on methods set by the Association for the Advancement of Medical Instrumentation (AAMI). Prior to subject enrollment, researchers were tested for accuracy of blood pressure measurement by performing 50 blood pressure readings. Study subjects were enrolled from a heterogeneous population and included a wide range of arm circumferences and blood pressure readings. Subjects' blood pressure was measured with three devices in a sequential fashion by two researchers. Results were analyzed using the Bland Altman plot. When comparing devices, the AAMI defines reliability as a mean difference and standard deviation in blood pressure readings falling within ± 5 mm Hg and ± 8 mm Hg, respectively.
RESULTS: Blood pressures were taken from 68 subjects for a total of 204 readings. When compared to the portable mercury sphygmomanometer, the OMRON had a mean difference and standard deviation in SBP of -0.4 ± 11.6 mm Hg, and in DBP of -3.3 ± 9.6 mm Hg. The Lumiscope had a mean difference and standard deviation in SBP of 2.4 ± 10.8 mm Hg, and in DBP of -0.3 ± 8.5 mm Hg.
CONCLUSION: Mean difference in SBP and DBP for both devices met the accepted ± 5 mm Hg. Standard deviations for both did not fall within the accepted ± 8 mm Hg. The reliability of SBP and DBP measurement over a wide range of blood pressures and arm circumferences for both devices was poor. The researchers strongly recommend reliability testing of monitors to insure appropriate detection and monitoring of hypertensive patients.

9. The effectiveness of pravastatin in the African-American population and factors associated with achievement of lipid goals: a retrospective, computer-based study. *Pang H. Chong, Pharm.D.*, Pamala J. Tzallas-Pontikes, Pharm.D., John D. Seeger, Pharm.D., M.P.H.; Harvard University, Boston, MA; Cook County Hospital, Chicago, IL.

PURPOSE: To describe the effectiveness of pravastatin (P) in achieving NCEP-defined LDL-C target levels in African-American (AA) patients and identify factors associated with successful therapy.
METHODS: Follow-up of 84 AA patients initiating therapy with P between October and November 1997, and continuing treatment for at least 6 months. Stepwise logistic regression to identify independent predictors of meeting target LDL-C. Medical record review of reason for failure to achieve target LDL-C.
RESULTS: The mean (SD) age for subjects was 64 (9) years, and 76.2% were female. The average daily dose of P was 27 (11) mg. Pair wise analyses identified LDL-C target level as the only significant predictor of achieving goal: 7 of 11 (64%) of those with a target LDL-C of 160 met this goal, while 13 of 41 (32%) of those with a target LDL-C of 130 achieved their goal, and only 4 of 32 (13%) of those with a target LDL-C of 100 achieved it (p=0.004). The stepwise logistic regression identified the target LDL-C (100, 130, or 160 mg/dl) as a significant predictor of achieving goal (reference = target of 100, if target = 130: OR = 4.39, 95% CI = 1.10-17.55, if target = 160: OR = 19.59, 95% CI = 3.39-113.44), and also identified a low baseline HDL-C (< 35 mg/dl) as a significant predictor of achieving goal (OR = 8.31, 95% CI = 1.36-50.82). Medical record review found noncompliance (5%), incorrect drug regimen (68.3%) and inadequate monitoring (26.7%) as reasons for not achieving goal.
CONCLUSION: Baseline lipid parameters (target LDL-C and low HDL-C) are predictive of achieving target LDL-C. Adequate monitoring, drug regimen, and compliance are also important.

10. Effect of statin therapy on atherosclerotic progression and major cardiovascular endpoints. *Dawn G. Zarembski, Pharm.D.*, David P. Agarrick, Ph.D., Amy H. Schwartz, Pharm.D.; Midwestern University, Downers Grove, IL.

PURPOSE: The purpose of this study was to combine the available date to assess the impact of statins on the progression of atherosclerotic disease and the incidence of major cardiovascular endpoints (MACE).
METHODS: Data from seven randomized, controlled angiographic trials comparing a statin agent (n=1397) with placebo (n=1378) in patients with documented stenosis were aggregated using standard meta-analytic techniques.
RESULTS: Statin therapy was associated with the following improvements in lipid parameters:

Lipid Variable	Parameter	Statin	Placebo
Total-C	Baseline	234.3	235.9
	% Δ	-20.8	0.3
LDL-C	Baseline	162.3	162.7
	% Δ	-28.3	0.4
HDL-C	Baseline	40.2	40.4
	% Δ	7.8	1.0
TG	Baseline	164.5	164.5
	% Δ	-13.5	2.4

The reduction in LDL-C and increase in HDL-C in the statin group was associated with a reduction atherosclerotic progression as assessed angiographically via reductions in the minimum lumen diameter (mean change = -0.032 mm vs -0.088 mm; pooled effect size -0.110 (CI -0.023 to -0.1966). Comparisons of cardiovascular events upon completion of the trials are as follows:

Endpoint	Statin(%)	Placebo (%)	Odds Ratio (CI)
Death/myocardial infarction	5.45	7.41	0.845 (0.607 - 1.177)
Procedures(PTCA/CABG)	13.0	17.3	0.811 (0.643 - 1.045)
MACE	18.0	26.7	0.799 (0.664 - 0.960)

CONCLUSION: Administration of a statin produced small, yet statistically significant reductions in angiographic evidence of atherosclerotic progression. In accordance with recent clinical trials, the incidence of MACE in patients with documented CAD was reduced among patients receiving statin therapy despite these modest reductions in progression of atherosclerotic disease.

11E. Hypersensitivity eosinophilia in advanced heart failure: a clinical marker for impending decompensation and cytokine deployment. *Patricia A. Uber, Pharm.D.*, Mandeep R. Mehra, M.D., Myung H. Park, M.D., Robert L. Scott, M.D., Richard Milaini, M.D.; Ochsner Medical Institutions, New Orleans, LA.

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12E. Safety of targeted institutional guidelines for eptifibatide in high risk patients with acute coronary syndromes: is bleeding increased? *Saeed Rasty, Pharm.D.*, Steven Borzak, M.D., A. Christian Held, M.D., Phillip Kraft, M.D., James E. Tisdale, Pharm.D.; Henry Ford Hospital, Detroit, MI; Heart and Vascular Institute, Detroit, MI; Wayne State University, Detroit, MI.

Presented at the 101st Annual Meeting of the American Society of Clinical Pharmacy and Therapeutics, Los Angeles, CA, March 16, 2000.

13. The effect of pravastatin and atorvastatin on coenzyme Q10. *Barry E. Bleske, Pharm.D.*, Richard A. Willis, Ph.D., Nicole Casselberry, Meeta Datwani, Mark Anthony, Ph.D., Michael J. Shea, M.D.; University of Michigan, Ann Arbor, MI; University of Texas, Austin, TX.

Coenzyme Q10 (CoQ10) is an antioxidant and plays an important role in the synthesis of ATP. Studies suggest that HMG-CoA reductase inhibitors reduce CoQ10 levels, however, no studies have directly compared HMG-CoA reductase inhibitors in a randomized crossover fashion. Differences in drug properties may result in different effects on CoQ10.

PURPOSE: To determine the effect of pravastatin and atorvastatin on CoQ10.
METHODS: Twelve healthy volunteers received either 20 mg pravastatin (P) or 10 mg atorvastatin (A) for four weeks in a randomized crossover fashion. There was a 4- to 8-week washout period between the two phases. CoQ10 levels and a lipid profile were obtained.
RESULTS: There was no difference in CoQ10 levels from baseline to post drug therapy for either P or A (0.62 ± 0.15 vs 0.61 ± 0.26 µg/ml and 0.65 ± 0.22 vs 0.6 ± 0.12 µg/ml, respectively; p>0.05). There was also no difference in the mean change in CoQ10 levels between P and A (0.01 ± 0.2 vs 0.05 ± 0.2 µg/ml; p=0.4). However, the percentage change in CoQ10 levels were variable with some patients decreasing their CoQ10 levels by 50%. There was a significant difference in LDL from baseline to post drug therapy for both P and A (97 ± 21 vs 66 ± 19 mg/dl and 102 ± 21 vs 52 ± 13 mg/dl, respectively; p<0.001). In addition, there was significant difference in the mean change in LDL levels between P and A (27.5 ± 12 mg/dl vs 50.5 ± 16 mg/dl; p=0.001). There was no significant correlation between LDL and CoQ10.
CONCLUSIONS: P and A had similar effects on CoQ10 levels despite A having a greater effect on lowering LDL. Routine supplementation of CoQ10 appears not to be warranted except perhaps in select patients.

14. Risk of bleeding with glycoprotein IIb/IIIa receptor antagonists in patients undergoing coronary intervention at a community hospital. *Lynette R. Moser, Pharm.D.*, Mustafa Hashem, M.D., Nicole Tocco, Julie Michael, Thomas LaLonde, M.D., Michael Romanelli, M.D., Arshad Ali, M.D.; Wayne State University, Detroit, MI; St. John Hospital and Medical Center, Detroit, MI.

PURPOSE: This study evaluated the safety profile of the glycoprotein IIb/IIIa receptor antagonists (GPRA) in patients undergoing percutaneous coronary intervention (PCI) at a community teaching hospital.
METHODS: Medical records of 273 patients receiving GPRA between July 1997 and January 1999 were reviewed and evaluated according to type of GPRA used, major and minor bleeding as defined by TIMI investigators, concomitant use of other antiplatelet and anticoagulant agents, and risk factors associated with increased bleeding complications. All prescribing was at the discretion of the individual cardiologist.
RESULTS: Abciximab (A), eptifibatide (E), and tirofiban (T) were used in 60 (22%), 54 (20%), and 159 (58%) patients, respectively. All patients received aspirin. Sixty-five percent received clopidogril and 15% ticlopidine. All patients prescribed A received heparin at 400 to 500 units/hour. All patients on E and T received full dose IV heparin. Bleeding complications occurred in 49 (18%) patients (A-14, E-8, T-27). Major bleeds occurred in seven patients (A-3, E-1, T-3). One patient receiving A died of bleeding complications. There were no intracranial bleeds. Peak PTT was significantly higher among patients with bleeding complications (49 seconds vs 61 seconds, p<0.03). Serum creatinine was also higher in patients with bleeding complications (1.1 mg/dl vs 1.8 mg/dl, p<0.001). A history of hypertension and peripheral vascular disease were significantly more prevalent in patients with bleeding complications (p<0.002 and p<0.003, respectively).
CONCLUSION: GPRA can be safely used in most patients undergoing coronary intervention. Risk of major bleeding should be assessed to assure careful patient selection and monitoring.

15. Assessment of control of hypercholesterolemia in a managed care setting. *Reza Taheri, Pharm.D.*, Lori Amborn, Pharm.D., James C. Smith, M.D., Sue Cooper, R.Ph., M.S., Agnes Tan, Ph.D., Robert J. Straka, Pharm.D.; HealthPartners/Regions Hospital, St. Paul, MN; University of Minnesota, Minneapolis, MN.

PURPOSE: To describe the extent of control of hypercholesterolemia (HC) in a not-for profit managed care organization (MCO) by integrating data from medical, laboratory and pharmacy claims databases.
METHODS: Members of a staff model MCO ≥ 18 years of age who have been continuously enrolled from July 1, 1996 to June 30, 1998 were included. Medical, laboratory, and pharmacy claims databases were integrated to identify patients at various risk levels for coronary heart disease (CHD) and the extent to which they met LDL-C goal based on the National Cholesterol Education Program (NCEP) guidelines.
RESULTS: A total of 124,971 patients were identified to be continuous members of the plan for the specified timeframe of the search. The following summarizes the extend of lack of control of hypercholesterolemia:

	Pts with CHD (n=6,538) Total No. (%; % of group on AH)	Pts without CHD and ≥ 2 RFs[¥] (n=17,267) Total No. (%; % of group on AH)
Patients without LDL measurement	2,170 (33; 7)	10,131 (59; 1)
Patients with LDL measurement	4,368 (67; 61)	7,136 (41; 25)
LDL<100	1,523 (35; 71)	1,091 (15; 31)
LDL 101-130	1,491 (34; 61)	2,207 (31; 27)
LDL 131-160	778 (18; 44)	2,140 (30; 20)
LDL>160	363 (8; 48)	1,136 (16; 21)
LDL not calculated (triglycerides > 400 mg/dl)	213 (5; 69)	562 (8; 34)

[¥]RF= risk factor; *AH = antihyperlipidemic agent

CONCLUSION: A significant proportion of patients remain untreated or undertreated based on the NCEP guidelines. Given that 33% of the CHD population does not have a fasting cholesterol measurement to begin with and there are limitations in enumerating risk factors from the electronic database, the degree of adequate control of HC might well be overestimated in this report. Realizing the need for improved HC management in this MCO, we plan to implement a program, based on a collaborative pharmacist/physician effort, to improve the quality of lipid management.

16. Comparative diagnostic accuracy of adenosine, dipyridamole and dobutamine myocardial perfusion imaging: a meta-analysis. *Susan Heineman, Pharm.D.*, Michelle Faulkner, Pharm.D., Pamela Foral, Pharm.D., Daniel E. Hilleman, Pharm.D.; Creighton University, Omaha, NE.

PURPOSE: Adenosine (ADO), dipyridamole (DIP) and dobutamine (DOB) have all been used extensively as pharmacologic adjuncts to radioisotopic myocardial perfusion imaging. Unfortunately, no direct comparative trials between these agents have been conducted. We performed a meta-analysis of published trials with those agents to compare their diagnostic accuracy and safety.
METHODS: A total of 40 trials were identified including 16 with ADO, 15 with DIP, and 9 with DOB. Mean sensitivity, specificity, positive and negative predictive accuracy and overall diagnostic accuracy were calculated and weighted by sample size and study variance. Mean incidence of side effects, side effects requiring intervention and/or drug discontinuance were also calculated and weighted by sample size and study variances. Results were compared using ANOVA.
RESULTS:

Outcome	ADO	DIP	DOB
Sensitivity (%)	89.9 ± 5.0	84.5 ± 12.0	85.8 ± 11.7
Specificity (%)	83.2 ± 10.2	78.2 ± 18.1	74.4 ± 11.9
+ Predictive value (%)	92.3 ± 8.2	90.0 ± 4.2	93.0 ± 4.2
- Predictive value (%)	72.9 ± 7.4	61 ± 32.5	48.0 ± 21.2
Diagnostic accuracy (%)	88.4 ± 5.5	94.5 ± 4.9	77.7 ± 14.0
Overall side effects (%)	71.4 ± 19.2*	46.7 ± 11.0	57.7 ± 18.5
Side effects requiring intervention (%)	3.0 ± 7.7*	21.7 ± 19.8	25.3 ± 12.7
Side effects requiring drug discontinuance (%)	1.5 ± 2.6*	3.4 ± 6.4	6.8 ± 11.9

*p<0.05 compared to the other two drugs

CONCLUSION: The diagnostic accuracy of the three agents was not significantly different. ADO was associated with a significantly higher incidence of overall side effects than DIP or DOB, but a significantly lower risk of side effects requiring medical intervention or drug discontinuance. ADO is the preferred pharmacologic adjunct to myocardial perfusion imaging.

17. Crossover comparison of gemfibrozil and fenofibrate in patients with type IIA or IIB dyslipidemia. *Thomas L. Lenz, Pharm.D.*, Daniel E. Hilleman, Pharm.D., Michael S. Monaghan, Pharm.D.; Creighton University, Omaha, NE; Allied Health Professions, Omaha, NE.

PURPOSE: There are presently no data comparing the lipid lowering effects of gemfibrozil and fenofibrate. Studies comparing other fibric acid derivatives suggest that drugs in this class may not be interchangeable with regard to their effect on specific lipid fractions. The objective of the present study was to compare the lipid-lowering effects of gemfibrozil and fenofibrate in patients with coronary artery disease and either type IIA or type IIB dyslipidemia.
METHODS: A total of 40 patients (30 men/10 women) with a mean age of 57 ± 14 years comprised the study population. All patients had coronary artery disease defined as a history of myocardial infarction, coronary revascularization (CABG or PTLA) or ≥ 70% stenosis of a major epicardial coronary artery confirmed by coronary angiography. Eleven patients had type IIA dyslipidemia and 29 patients had type IIB dyslipidemia. Twenty-seven patients were currently receiving an HMG-CoA reductase inhibitor. Seventeen patients had type II diabetes mellitus. All patients were receiving gemfibrozil at a dose of 600 mg twice daily for a minimum of six months (mean duration 23 ± 8 months). A fasting lipid profile was obtained within two weeks prior to the switch to fenofibrate. All patients were initiated on fenofibrate 201 mg daily. A fasting lipid profile was obtained a minimum of eight weeks (mean duration 11 ± 2 weeks) after the switch to fenofibrate. Differences in mean lipid values between the treatment periods were evaluated using Fisher's exact test.
RESULTS: All 40 patients successfully completed the switch from gemfibrozil to fenofibrate with a minimum clinical follow-up on fenofibrate of three months. No new adverse effects were reported following the switch to fenofibrate. Fenofibrate was associated with greater reduction in total cholesterol (16% vs 12%), LDL-cholesterol (18% vs 13%), and triglycerides (49% vs 40%), and greater increases in HDL-cholesterol (19% vs 15%), than gemfibrozil. Fenofibrate was more effective than gemfibrozil in both type IIA and type IIB dyslipidemia. The magnitude of the difference between gemfibrozil and fenofibrate was significant (p<0.05) only for total cholesterol, LDL-cholesterol and triglycerides in type IIB patients.
DISCUSSION: Our study is the first to directly compare gemfibrozil and fenofibrate in a crossover design. Our results indicate that fenofibrate has a

greater effect on total cholesterol, LDL-cholesterol and triglycerides, particularly in type IIB dyslipidemia patients. Our data also suggests that gemfibrozil and fenofibrate are equally well tolerated.

18. Evidence-based approach to formulary selection of angiotensin receptor blockers: a meta-analysis. *Thomas L. Lenz, Pharm.D.*, Ali Syedroudbari, Pharm.D., Daniel E. Hilleman, Pharm.D.; Creighton University Cardiac Center, Omaha, NE.

PURPOSE: The angiotensin receptor blockers (ARBs) have become a potentially useful class of antihypertensive agents, particularly as alternate therapy to the angiotensin converting enzyme inhibitors. With the proliferation of drugs in this class, decisions regarding the drug product selection have been made difficult. The objectives of this study are to compare the efficacy and safety of the different ARBs based on a review of their package inserts and a literature-derived meta-analysis of published studies. The results of this analysis will be sued to make drug product selection and formulary recommendations.
METHODS: A literature search was conducted using MEDLINE. The pool of reported studies was restricted using standard selection criteria for randomized, controlled trials. The following variables were extracted from each report for which values were available: mean and standard deviation of change in supine systolic and diastolic BP from baseline to end of treatment; incidence of all AEs; and incidence of withdrawal because of AEs. These averages were also weighted according to study sample size and according to an estimate of the study variance to address issues of bias in sample size or variance across studies.
RESULTS: A total of 53 placebo-controlled or active-controlled studies were included in the analysis. Based on package insert data, no significant differences were observed among any of the ARBs with regard to BP lowering or AE incidence. Based on the literature derived meta-analysis, candesartan, telmisartan and irbesartain lowered BP to a small (~2.8 mm Hg) but statistically significant greater extent than valsortan or losartan. AEs were not different based on the meta-analysis. Differences in kinetic/dynamic characteristics of the drugs were observed. Trough/peak BP ratio was superior with telmisartan/candesartan.
DISCUSSION: We conclude that the ARBs are an effective and safe group of drugs in the management of hypertension. The BP lowering differences among the individual ARBs are generally minimal. However, it does seem feasible, based on the available evidence, to be able to select one or two of these agents for inclusion on restricted formularies that pose fewer therapeutic obstacles than other agents in the class.

19. The impact of perioperative magnesium sulfate administration on the incidence of atrial fibrillation in postoperative coronary artery bypass and/or valve repair surgery patients. *Michael Shara, Pharm.D., Ph.D.*, Thomas Langdon, M.D.; Creighton University, Omaha, NE; Alegent Health Immanuel Medical Center, Omaha, NE.

PURPOSE: This study was carried out to determine the impact six 2-gram doses of intravenous of magnesium sulfate ($MgSO_4$) administration on the incidence postoperative atrial fibrillation (A-Fib) in patients undergoing coronary artery bypass graft (CABG) and or valve repair surgery.
METHODS: Seventy-five of 150 patients undergoing CABG/valve repair surgery received an intravenous solution consisting of 2 g $MgSO_4$ (in 50 ml of 5% dextrose) over 15 minutes at the time of cross-clamp removal for cardiopulmonary bypass pump (CBP) patients or at chest closer for off CBP. A second dose was given over four hours in the ICU within two to four hours post-op. Doses three to six were given on post-op days one through four. Serum magnesium concentrations were measured pre-op and on days one and three post-op. The 75 patients in the control cohort group did not receive $MgSO_4$. Postoperative A-Fib for the two groups was documented.
RESULTS: Fifteen of 75 patients developed postoperative atrial fibrillation in the $MgSO_4$ group compared to 27 of 75 in the control group. The 44.4% reduction of post-operative A-Fib in the $MgSO_4$ group was statistically significant ($p<0.029$). We observed no magnesium-related adverse effects during this study.
CONCLUSIONS: These findings indicate that the administration of 12 grams (97 mEq) $MgSO_4$ over five days perioperatively is safe and effective in reducing the incidence of post-operative atrial fibrillation. Our findings are in agreement with others reporting significant reductions in post-operative A-Fib utilizing different magnesium protocols in CABG/valve repair surgery patients. Further study is warranted to determine the optimal safe and effective utilization magnesium in A-Fib prevention.

20. Trends in the use of pharmacological agents in the management of hypertension and compliance to the Joint National Committee on the Detection, Evaluation and Treatment of High Blood Pressure (JNC-VI) guidelines in a metropolitan area. *Judy W.M. Cheng, Pharm.D., BCPS*, Michelle M. Kalis, Ph.D., Stanley Feifer, M.S.; Long Island University, Brooklyn, NY; New York University Health System, New York, NY; Massachusetts College of Pharmacy and Health Sciences, Boston, MA.

PURPOSE: Describe antihypertensive utilization patterns to: 1) compare antihypertensive therapy usage to JNC-VI treatment guidelines; 2) evaluate trends in hypertension management; 3) identify factors affecting prescribing patterns.
METHODS: Patients filling antihypertensive prescriptions in university-affiliated community pharmacies were enrolled. Data collected included: demographics, types of medical insurance and primary physician, medical and medication histories and current blood pressure (BP). Compliance to JNC-VI was defined as the use of recommended agents or appropriate alternative if patients were contraindicated to first-line therapies.
RESULTS: Four hundred ninety-nine patients (222 male, 277 female, age 62.5 ± 13.3 years) from 102 community pharmacies participated. Antihypertensive agents utilized were: 45% diuretics, 42% angiotensin converting enzyme inhibitors, 40% beta-blockers, 38% calcium channel blockers, 11% angiotensin II inhibitors (AgII), and 18% miscellaneous agents. Over a 12-month period, there was a trend toward increased usage of AgII (6% during months 1-4; 14% during months 8-12). Three hundred thirty-seven patients (67.5%) received more than one antihypertensive agents. Internists managed 72% of the patients, and 67% of patients' BP were controlled. Therapy was in compliance with JNC-VI in 400 patients (80%). Compliance was higher in patients with higher level of education ($p=0.003$).
CONCLUSION: Although JNC-VI guidelines were being followed in majority of patients (80%), BP control was suboptimal (67%) and issues such as patient adherence and dosage level should be considered. Level of education affected compliance with JNC-VI. Patients with higher level of education may be better informed thus ensuring appropriate therapy being used.

21. Acute myocardial infarction in West Virginia. *B. Daniel Lucas, Jr., Pharm.D.*, Leslie D. Adkins, B.S., Mark C. Bates, M.D., Mary K. Emmett, Ph.D., J. Gregory Rosencrance, M.D., David E. Seidler, M.D., John T. Wulu, Ph.D.; Camcare Health Education and Research Institute; West Virginia University, Charleston, WV.

BACKGROUND: National data regarding presentation and treatment patterns of acute myocardial infarction (AMI) are known; however, data specific to WV are largely unknown.
PURPOSE: To provide a description of the WV population experiencing AMI including the diagnostic and treatment strategies and subsequent patient outcomes.
METHODS: Data were extracted between July 1998 and June 1999 from a multicenter observational cross sectional national AMI registry containing data representing 23 of the 59 WV hospitals.
RESULTS: The mean age was 70 years (n=1648). Forty-four percent were female. Pre-existing cardiovascular disease and diabetes were present in 41% and 32%, respectively. Q-wave and non-Q-wave infarcts occurred 37% and 63%, respectively. Fifty-nine percent of patients eligible were treated with reperfusion therapy. Medications received within 24 hours of AMI and upon discharge, respectively, include: ACE-inhibitors 22% and 37%, aspirin 81% and 71%, β-blockers 46% and 55%. Other medications received within 24 hours include calcium channel blockers (15%), heparin (78%) and IIb/IIIa inhibitors (4%). Other therapies given before discharge include estrogen (female only 4%), a lipid lowering agent (21%) and smoking cessation advice to smokers (22%). Total and ICU/CCU lengths of stay were 4.2 and 2 days, respectively. Resource utilization included angiography (24%), PTCA with stent (1%), PTCA without stent (4%), CABG (4%), IABP (2%), echocardiography (42%) and stress testing (6%). Clinical events included death (8.4%), recurrent MI (1%), major bleeding (1.5%), total stroke (1.4%), intercerebral hemorrhage (0.4%) and thromboembolic stroke (0.4%).
CONCLUSION: A descriptive analysis of AMI in WV is provided. Findings suggest the need for changes in clinical practice and educational interventions.

Critical Care

22. Evaluation of factors influencing the estimation of creatinine clearance in burn patients. Charles R. Bonapce, Pharm.D., *Kurt R. Lorenz, Pharm.D.*, John A. Bosso, Pharm.D., Roger L. White, Pharm.D.; Medical University of South Carolina, Charleston, SC.

PURPOSE: To evaluate formulas to predict CL_{cr} in burn patients and identity factors associated with CL_{cr}.
METHODS: We compared the measured CL_{cr} determined from a 24-hour urine collection in 27 adult burn patients with varying degrees of thermal injury to the CL_{cr} calculated using the Cockcroft and Gault (C&G) without weight factors, C&G with actual body weight (C&G-ABW), and Jelliffe, 1973. In 17 of these patients with available height data, C&G lean body weight (C&G-LBW) was also assessed. Other factors such as age, ABW, S_{cr}, % second degree burn (% 2°), % third degree burn (% 3°), and days post burn (Days) were assessed using stepwise multiple regression to determine the impact on measured CL_{cr}.
RESULTS: The mean (SD) age (years), weight (kg), % 2°, % 3°, and Days were: 43 (15), 85 (16), 19 (16), 27 (25), and 8 (3), respectively. Median measured CL_{cr} was 128 ml/min (range 19 to 191). CL_{cr} was best predicted using C&G-ABW ($r=0.780$, mean error [ME] 3, root mean square error [RMSE] 37). For the subset of 17 patients, C&G-LBW had the highest

correlation (r=0.741) and lowest RMSE (39); however C&G-ABW had the lowest ME (7). Consistent with previous findings, these formulas underestimated the CL_{cr} (median = 39 ml/min) when the measured CL_{cr} was high (> 70 ml/min). Using multiple regression, no factors other than age, ABW, and S_{cr} were included in the final model and accounted for 68% of the variability (r^2=0.675) in measured CL_{cr}.
CONCLUSION: Of the factors studied, only age, ABW, and S_{cr} were predictive of measured CL_{cr} as found in multiple regression analysis and the C&G-ABW formula.

23E. In vivo effect of antisecretory agents on immunomodulation and T-lymphocyte proliferation. *Jill A. Rebuck, Pharm.D.*, Kimberly L. Bergman, Pharm.D., Samuel J. Pirruccello, M.D., Keith M. Olsen, Pharm.D.; University of Nebraska Medical Center, Omaha, NE.

24E. Thrombocytopenia-associated costs in an adult intensive care unit population. *Jill A. Rebuck, Pharm.D.*, Gary C. Yee, Pharm.D., Thomas E. Peddicord, Pharm.D., Casey Nelson, Gary Cochran, Pharm.D., Keith M. Olsen, Pharm.D.; University of Nebraska Medical Center, Omaha, NE.

Presented at the 29th Annual Society of Critical Care Medicine Educational and Scientific Symposium, Orlando, FL, February 11-15, 2000.

25. Effect of lansoprazole suspension versus continuous intravenous ranitidine infusion on gastric pH of mechanically ventilated intensive care unit patients. *Kevin W. Roberts, B.S., Pharm.D.*, W. Douglas Pitcher, M.D., Byron Cryer, M.D.; Veterans Affairs Medical Center, Dallas, TX; University of Texas Southwestern Medical School, Dallas, TX; University of Texas, Austin, TX.

PURPOSE: This study compared the effect of a compounded lansoprazole suspension versus continuous intravenous (IV) ranitidine infusion on gastric pH of mechanically ventilated, adult intensive care unit (ICU) patients. We evaluated 1) the time to achieve a gastric pH of > 4; and 2) the mean pH after starting therapy, as intermediate efficacy markers of acid suppressive, stress ulcer prophylactic therapy. In addition, we conducted a cost comparison to estimate the impact of utilizing lansoprazole suspension as the primary choice for stress ulcer prophylaxis therapy.
METHODS: A 48-hour, prospective, randomized, double-blind, double-dummy controlled trial evaluating the effect of lansoprazole suspension (30 mg q12 hours) by nasogastric (NG) tube versus ranitidine 6.25 mg/hour IV infusion on gastric pH of twenty mechanically ventilated, adult ICU patients. Gastric pH was assessed by scheduled withdrawals of 5 ml gastric juice (through NG tube) and independent evaluation using a glass pH probe and an observer blinded to study treatment. The cost comparison reflects the financial characteristics of the Veterans Affairs medical center (VAMC) with annualized projections based upon 4000 patient-ventilator days/year in the ICUs of the Dallas VAMC.
RESULTS: Lansoprazole suspension achieved a gastric pH > 4 within one hour of administration while intravenous ranitidine required four hours ($p<0.05$). Lansoprazole suspension achieved a significantly greater mean gastric pH than continuous intravenous ranitidine (6.7 vs 4.7; $p<0.05$). Lansoprazole suspension may provide an estimated cost savings of $15,720/year.
CONCLUSION: Lansoprazole suspension provides an effective, cost saving alternative to ranitidine infusion for stress ulcer prophylaxis in the mechanically ventilated, adult ICU patient.

26. Sputum and serum antibiotic concentrations after instilled or nebulized imipenem or tobramycin in ICU patients maintained on mechanical ventilation. *Dra. Dolors Soy*, N. Corominas, M. Adrover, M. Sarasa, A. Alarcon, C. Codina, A. Tores, J. Ribas; Fundació Clínic; Hospital Clinic Barcelona, Barcelona, Spain.

Nosocomial pneumonia due to *Pseudomonas aeruginosa* and other pathogens are a common problem in intensive care unit (ICU) patients maintained on mechanical ventilation. Treatment with intravenous antibiotics are ineffective in many patients due to antibiotics penetrate endobronchial secretions poorly. The direct delivery of antibiotics by inhaled administration could allow us to attain an efficacious drug concentration in the site of infection.
PURPOSE: The aim of this study is to determine the optimum delivery drug system: endotracheal instillation versus nebulization that allow us to achieve efficacious sputum imipenem (I) or tobramycin (T) concentrations.
METHODS: The study include 18 ICU patients submitted to mechanical ventilation with documented infection due to *P. aeruginosa*. Nowadays, nine patients have been included. Nebulized or instilled I: 1000 mg/8h or T: 200 mg/12h were administered according to a random list. This study were approved by the hospital ethics committee and written informed consent was obtained from all participants. Four sputum samples and two blood samples were collected over 12 hours and analyzed for I or T by high performance liquid chromatography (HPLC).
RESULTS: The study is still ongoing. The preliminary results are:

Patient	Drug	Route	Sputum C1h	Sputum C2h	Sputum C6h	Sputum C8h	Sputum C12h	Serum Trough	Serum C1h
1	Imipenem	instilled	12340	2500	1300	ND	--	4.55	27.19
8	Imipenem	instilled	15830	7590	ND	ND	--	6.5	9.35
4	Imipenem	nebulized	2.9	750	21.83	0.7	--	ND	0.5
7	Imipenem	nebulized	3387	8098	0.71	ND	--	ND	ND
2	Tobramycin	nebulized	12.61	0.375	0.09	--	ND	ND	ND
5	Tobramycin	nebulized	30.59	1.55	ND	--	ND	ND	ND
8	Tobramycin	nebulized	5.7	ND	327	--	ND	ND	ND
9	Tobramycin	nebulized	30.5	ND	9.9	--	ND	ND	ND
3	Tobramycin	instilled	47.46	0.63	0.73	ND	--	18.58*	23.36*
6	Tobramycin	instilled	30.35	ND	ND	ND	--	ND	ND

ND = none detected; concentrations in µg/ml; *IV tobramycin administration by error

DISCUSSION: Sputum antibiotic concentrations were over the minimum inhibitory concentration (MIC) of *P. aeruginosa* and other gram negative bacilli during the first hours after administration. No significant antibiotic absorption to attain toxic serum drug concentrations was observed. As the instilled route is more feasible to use and there were no differences (related to MIC) in sputum antibiotic concentrations between two routes, antibiotic instillation could be a good treatment in ICU patients. More patients should be included in this study for final conclusions.

Drug Delivery

27. The expression of transport proteins in human umbilical vein endothelial cells. *Timothy R. McGuire, Pharm.D.*, Eric B. Hoie, Pharm.D., Donald W. Miller, Ph.D.; University of Nebraska, Omaha, NE.

PURPOSE: Human umbilical vein endothelial cells (HUVEC) are commonly used to study the structure and function of vascular endothelium. Despite the common use of HUVEC to study transport, little is known about their transporter content. The purpose of this research is to evaluate whether HUVEC express the multiple drug-resistant associated protein-1 (mrp-1) and p-glycoprotein (pgp).
METHODS: Functional mrp-1 and pgp were assessed using the intracellular exclusion of fluorescein, an mrp-1 substrate, and rhodamine, a pgp substrate. Fluorescein (100 µM) and rhodamine (3.2 µM) accumulation were measured using fluorescence spectrophotometry after 60 minutes exposure. Indomethacin (10 µM) was used to inhibit mrp-1 in this functional assay and cyclosporine (1.6 µM) was used to inhibit pgp. Direct measurement of pgp and mrp-1 protein was performed using Western Blot and rtPCR.
RESULTS: Functional experiments demonstrated that the mrp-1 substrate fluorescein achieved low intracellular concentrations which increased with indomethacin. No similar effect was seen with pgp substrate rhodamine and its inhibitor cyclosporine. Immunoblots revealed a 190 kD band identical to the band seen in a pancreatic cancer cell line which highly express mrp-1. HUVEC lysates showed no band at 170 kD where the pgp band migrates in lysates of KBv cancer cells. RtPCR showed a strong signal corresponding to mrp-1 mRNA.
CONCLUSIONS: These data show that HUVEC are a pgp negative and mrp-1 positive cell. HUVEC should be used with care when evaluating drug transport given that many drugs are pgp substrates.

28E. Use of Heliox™ to deliver albuterol by nebulization: an in vitro evaluation. *Barry A. Browne, Pharm.D.*, Robert O. Williams, Ph.D., True Rogers, Ph.D.; University of Texas at Austin, Austin, TX.; Scott & White Memorial Hospital, Temple, TX.

Presented at the 1999 Annual Meeting of the American Association of Pharmaceutical Scientists, New Orleans, LA, November 17, 1999.

29. Prophylaxis of *Pneumocystis carinii* pneumonia with atovaquone suspension: sachets or bottles? *Laurel M. Adams, Ph.D.*, Mark S. Shaefer, Pharm.D., R. Steve Crockett, Ph.D., P. Shalit, M.D.; Glaxo Wellcome Inc., Research Triangle Park, NC; D.A.T.A., Inc., Murray, KY; Swedish Medical Center, Seattle, WA.

PURPOSE: To determine whether acceptability of atovaquone suspension for *Pneumocystis carinii* pneumonia (PCP) prophylaxis is affected by package form and to assess subject/physician preference for atovaquone versus alternative therapies.
METHODS: In this open-label, multicenter, crossover study, HIV-infected subjects with CD_4 count ≤ 200 uL or prior PCP regardless of CD_4 counts were randomized to receive atovaquone suspension (1500 mg daily) packaged in unit-dose sachets or multidose bottles. After 21 days, subjects switched to the alternative package form. Questionnaires were used to assess package form preferences and comparative attributes with prior therapies.
RESULTS: Of 97 subjects who took atovaquone, 85 were men, 45 had previous PCP, and 92 had received prior PCP prophylaxis. Eighteen subjects reported at least one adverse effect (AE); diarrhea (7) and nausea (4) were most common. Eight subjects withdrew due to an AE, five during bottle use. Of the 66 subjects who indicated a package form preference, equal numbers (33) favored the sachet and the bottle overall; however, mean scores for ease of carry, ease of measure, and spilling significantly favored the sachet and ease of opening favored the bottle. Compared to prior PCP prophylaxis, mean rating scores for the preferred form of atovaquone were similar to dapsone, significantly more favorable than pentamidine for all attributes, and more favorable than cotrimoxazole for ease of swallow and less favorable for ease of carry. Atovaquone was rated by physicians as the same or better than other

prescribed therapies.
CONCLUSION: Based on subject and physician survey responses, atovaquone suspension is acceptable and well tolerated for PCP prophylaxis in HIV-infected subjects. Patients equally preferred sachets and bottles, with a general preference for bottles at home and sachets when traveling.

Drug Metabolism

30. In vitro uptake and partitioning of oxaliplatin in human red blood cells. *Sophie Jobard, Pharm.D.,* Olivier Heudi, Pharm.D., Annie Cailleux, M.D., Nicole Borgnis-Desbordes, Pharm.D., Pierre Allain, P.H.D.; University Hospital, Brest, France; University Hospital, Angers, France.

PURPOSE: Clinical studies with oxaliplatin (OP) showed its accumulation in red blood cells (RBCs). However, the mechanism of penetration and the target of the drug inside the RBCs are unknown. This study deals with some pharmacokinetic aspects of the uptake and binding of OP inside RBCs.
METHODS: OP at different concentrations was incubated at 4°, 21° and 37°C with RBCs in suspension in isotonic chloride solution. The uptake of OP at various time was evaluated by the determination of total platinum (Pt) in RBCs supernatant using coupled plasma-mass spectrometry (ICPMS), and the binding of OP was studied on RBCs hemolysate by coupling gel chromatography to ICPMS.
RESULTS: More than 60% of Pt was irreversibly bound to RBCs after three hours of incubation. The rate of uptake of OP by RBCs at 4°, 21° and 37 °C was 0, 12 and 63%, respectively and was not saturable at a concentration of OP corresponding to 243 mg/L of Pt. Within the RBCs, 70% of the Pt recovered was bound to a protein whose retention time was similar to hemoglobin; the other 30% of Pt corresponded to unidentified low molecular weight species (< 5 kDa).
CONCLUSION: This study suggests that the uptake of OP appears to be dependent on a both passive and active mechanism and that within the RBCs, OP is mainly bound to hemoglobin. The amount of OP sequestered by RBCs presumably represents inactive fraction of the drug.

Education

31. Advancement examinations at U.S. pharmacy schools. *Gina J. Ryan, Pharm.D.*, Diane Nkyamp, Pharm.D., Z. Tom Grapes, Ph.D., Robert J. Anderson, Pharm.D., William N. Kelly, Pharm.D.; Mercer University, Atlanta, GA.

PURPOSE: To assess schools of pharmacy regarding experience with testing students knowledge prior to the beginning of their advance practice experience rotations.
METHODS: A survey was sent to 76 schools of pharmacy in May 1998. The schools were surveyed regarding demographics of the pharmacy school, test formats used in the curriculum, administration of advancement or self-assessment exam, and rationale if the school did or did not administer advancement exams. Schools that administer an advancement exam were also questioned regarding the format, student year of matriculation, test content, advantages/disadvantages of administering this exam and consequences resulting from exam failure.
RESULTS: Forty-six (60%) completed surveys were returned. Thirty-seven (80%) of schools did not administer advancement exams. The main reason for not administering the exam included: 1) students' knowledge had previously been tested (35%); 2) faculty were unsure what to do with the results (32%); 3) faculty had not considered testing (32%). Five (11%) schools stated they were in the process of implementing an advancement exam. Nine (20%) schools already administer an advancement exam. The primary rationale for administering the exam was to encourage students to review material prior to advancement.
CONCLUSION: The information collected has resulted in our school implementing a required, self-assessment therapeutics examination prior to starting advanced practice experiences.

32. Method for rapid evaluation of student comprehension and delivery of learning objectives in nephrology therapeutics block. *Ruth Ann Subach, Pharm.D.,* Marian Paynter, Pharm.D.; Western University of Health Sciences, Pomona, CA.

PURPOSE: Pharmacy courses at Western University are taught in 18-day blocks. One challenge with this system is the need for rapid assessment of student comprehension. We describe how we evaluated student comprehension, how well the course objectives were delivered, how daily feedback was provided, how student assessment was performed, and student outcomes during the 8-day nephrology portion of a block.
METHODS: Twelve student teams completed a daily assignment designed to evaluate student comprehension and assess delivery of the learning objectives. Each day, teams compiled the following: 1) three to five key concepts of the day; 2) questions about the material; and 3) three to five multiple choice questions based on that day's material, including an explanation of why each potential answer was correct or incorrect. This information was e-mailed to the faculty member. Key concepts were compared to the learning objectives. Questions about the material were addressed in class the next day or by e-mail/Internet. Multiple choice questions were compiled, edited, and placed on the Internet before the next class session. Two quizzes and one exam were administered.
RESULTS: Key concepts uniformly aligned with course learning objectives. Most teams submitted three multiple choice questions each day; all were "recall" questions. The pass rates on the first and second quizzes were 99% and 100%, respectively. Sixty-eight of 103 students scored ≥ 90% on the exam.
CONCLUSIONS: This process was labor-intensive, but provided timely and valuable information about delivery of material and student comprehension. We believe daily faculty-student feedback, with the aid of technology, may facilitate the learning process.

33. Student interest in postgraduate training. *Sheila R. Botts, Pharm.D., BCPP,* Tina J. Kanmaz, Pharm.D., Alexandra L. Stirling, Pharm.D., J. Andrew Skirvin, Pharm.D., William B. Dreitlein, Pharm.D., Gladys M. El-Chaar, Pharm.D.; St. John's University, Jamaica, NY.

PURPOSE: To justify the need for a university-sponsored residency/fellowship program, we conducted a student survey to characterize knowledge and interest in clinical postgraduate training opportunities. METHODS: Surveys were developed and subsequently approved by a university survey committee. Surveys were distributed to four area colleges of pharmacy in New York and New Jersey. Students at each college completed surveys anonymously and voluntarily.
RESULTS: Ninety-two percent (435) of students completing the survey were in the fourth or fifth year of the B.S. program. Most students reported receiving information on postgraduate training by the fourth year of the undergraduate program; however, only 52% felt the information was at least adequate to make a decision. Thirty-eight percent planned to complete a Doctor of Pharmacy degree and 34% indicated an interest in other postgraduate programs. Twenty-eight percent planned to complete a pharmacy practice residency, 18% a specialty practice residency, and 8% a fellowship. The most commonly cited reasons for pursuing postgraduate training were: broaden job opportunities, needed for career goals, build confidence, and increase earnings. Negative factors included loss of income, time commitment, unnecessary for career goals, and inadequate information to make a decision. The most important factors were geographic location and salary.
CONCLUSIONS: The significant number of students interested in postgraduate training combined with the importance of geographic location of training programs supports the need for development of additional training programs. Additionally, improvements are needed in regards to timeliness and quality of information provided to students.

34. Comparing fifth year doctor of pharmacy and fourth year medical students' outlooks on patient medication compliance and their impact as future practitioners. *Natalia Kujdych, Pharm.D.*; University of Mississippi, Jackson, MS.

PURPOSE: This study evaluates how fifth year doctor of pharmacy students and fourth year medical students regard patient medication compliance and their impact as future practitioners on patient compliance.
METHODS: A student survey was distributed to 29 pharmacy and 23 medical students in a conjoint bioethics course addressing the issues of patient medication compliance.
RESULTS: All pharmacy and medical students (p=0.0001) felt that patient counseling is an important step in obtaining patient medication compliance. Currently 95% of the medical students are involved with patient medication compliance counseling, whereas only 85% of the pharmacy students are involved. In their future professional practices, both groups intend to counsel their patients on the importance of medication compliance. All believe their efforts will result in positive outcomes. Ninety-five percent of the medical students feet that pharmacists should assist in this duty. One hundred percent of the pharmacy students vs 86% of the medical students feet that once daily dosing would be the easiest regimen for patient compliance. Fourteen percent of the medical students felt that twice daily dosing would increase compliance. Sixty-nine percent (p=0.0001) of the pharmacy students felt their patients would be more compliant to chronic then acute therapy whereas 91% (p=0.0001) of the medical students felt their patients would be more compliant to acute therapy.
CONCLUSION: Pharmacy students need the opportunity to start intervening earlier in their clinical education in patient medication compliance issues. The differences regarding dosing regimens and treatment of chronic disease may be due to fourth year medical students having more patient experience.

Endocrinology

35. Effects of glimepiride in patients with secondary failure to sulfonylureas. *Tracy A. Mascari, Pharm.D.,* Kjel A. Johnson, Pharm.D.;

University of Pittsburgh Medical Center, Pittsburgh, PA.

PURPOSE: To determine if glimepiride can further improve hemoglobin A_{1c} (HgA_{1c}) values in type 2 diabetics with secondary failure to glyburide or glipizide.
METHODS: It has been proposed that glimepiride can provide benefit over other sulfonylureas by its extrapancreatic effects. Patients with secondary failure, defined as taking glyburide ≥ 10 mg/day or glipizide ≥ 20 mg/day with a corresponding HgA_{1c} ≥ 8% and ≤ 11% were randomized into an 18 week, double-blind study. Inclusion criteria also included > 18 years, and BMI ≤ 30 kg/m^2. Demographically, HgA_{1c}, fasting glucose, nutritional, and exercise data were measured. Patients were randomized to continue glyburide/glipizide or begin glimepiride. Doses were escalated to glyburide 20 mg, glipizide 40 mg, or glimepiride 8 mg or until goal fasting glucose was < 120 mg/dl. The primary and secondary endpoints were change in HbA_{1c} and fasting glucose. Power analysis suggested 52 patients were needed to detect a 0.5% difference in HgA_{1c}. Data are presented as mean ± SD.
RESULTS: Thirty-three patients have been enrolled and 25 have completed the study for this interim analysis; 16 glyburide/glipizide and nine glimepiride patients. There was no difference between groups for age, exercise, or nutrition (p>0.2 for all comparisons). HgA_{1c} changed from 9.38 ± 0.97% to 8.98 ± 0.80% (p=0.046) for glyburide/glipizide and from 9.27 ± 0.78% to 9.44 ± 0.91% (p=0.57) for the glimepiride group; between group difference was 0.58% (p=0.24). Fasting glucose decreased from 187 ± 24 mg/dl to 172 ± 41 mg/dl (p=0.073) for glyburide/glipizide and from 180 ± 59 mg/dl to 169 ± 24 mg/dl (p=0.55) for the glimepiride group; between group difference was 4.5 mg/dl (p=0.049).
CONCLUSIONS: Glimepiride does not improve HbA_{1c} values in type 2 diabetics with secondary failure to sulfonylureas.

Gastroenterology

36E. Tracking stress ulcer prophylaxis. *Mary Beth Bobek, Pharm.D.*, Cheryl M. Ezman, Pharm.D., Michael Militello, Pharm.D., Alejandro C. Arroliga, M.D.; Cleveland Clinic Foundation, Cleveland, OH.

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Geriatrics

37. Predictors of warfarin use in elderly patients with atrial fibrillation. *Patricia A. Howard, Pharm.D., FCCP*, Edward F. Ellerbeck, M.D., M.Ph., Kimberly K. Engelman, Ph.D.; Kansas University Medical Center, Kansas City, KS; Kansas Foundation for Medical Care, Topeka, KS.

PURPOSE: To examine patterns of warfarin utilization in elderly patients with atrial fibrillation.
METHODS: We examined medical records of 637 Medicare beneficiaries discharged from Kansas hospitals between 4/1/98 and 9/30/98 with a principal or secondary diagnosis of atrial fibrillation. Exclusions included: unconfirmed or transient atrial fibrillation, active bleeding on admission, seizure disorder, dual chamber pacemaker, pericarditis, terminal illness, or refusal to take oral anticoagulants. Bivariate analysis was performed to determine associations between warfarin use and various demographic, clinical, and geographic variables
RESULTS: The analysis included 290 patients with a mean age of 79.3 years. Among these patients, 137 (47%) were discharged on warfarin while 69 (24 %) were discharged on aspirin. Warfarin utilization was not significantly related to peptic ulcer disease, fall risk, past history of bleeding, or liver disease. Warfarin was used in 40% of patient ≥ 85 years of age compared to 51% of those < 75 years, (p=0.29) Warfarin use was not increased in patients with additional risk factors for stroke including history of stroke (54%), heart failure (50%), hypertension (50%), or diabetes (49%). Patients in rural counties were just as likely to receive warfarin as those in urban counties (43% vs 45%, respectively, p=NS). Warfarin was less likely to be utilized in the 67 patients with intermittent atrial fibrillation (21% vs 55%; p<0.001)
CONCLUSION: Over half of Kansas Medicare patients with atrial fibrillation are not receiving oral anticoagulation in accordance with current guidelines. The underutilization of warfarin is poorly explained by risk factors for stroke, bleeding risk or geographic proximity to specialized cardiac care.

38. Assessment of alendronate compliance in a managed care setting. *Oralia V. Bazaldua, Pharm.D., BCPS*, Susyn Plushner, Pharm.D., BCPS, Barry Carter, Pharm.D., BCPS, Mark J. Ruscin, Pharm.D., BCPS; University of Texas, San Antonio, TX; Kaiser Permanente, Lakewood, CO; University of Colorado, Denver, CO.

PURPOSE: Little is known about how well patients comply with the appropriate use of alendronate. Because of alendronate's distinct method of administration, patients may not be receiving its full benefit due to poor compliance. This study determined the rate of compliance with appropriate alendronate use to evaluate the need for improvements in patient education.
METHODS: One hundred eighty-seven patients with a history of alendronate use were identified in four managed care clinics and 115 were eligible to participate in a telephone interview. A data collection form was developed that would address demographics, patient factors that may influence their use of alendronate, and a list of criteria as recommended by the manufacturer to determine proper use.
RESULTS: The compliance rate was 79% (91 of 115). Major reasons for noncompliance were concurrent administration of alendronate with other medications 46% (11 of 24), and with fluids other than water, 21% (5 of 24). Of the 37 patients that had discontinued alendronate by the time of the telephone interview, 24% reported self-discontinuation of the drug without advising their physician. No association was found between noncompliance and specific factors including demographic factors, level of education, number of concurrent medications or receipt of written or verbal information.
CONCLUSIONS: Compliance with appropriate alendronate use needs to be evaluated to assess the need for improvement in current educational methods. Specifically, the importance of not taking alendronate concurrently with other medications should be emphasized. Patients should be encouraged to advise their physicians before discontinuing medications on their own.

Health Services Research

39. Assessing the appropriateness of drug therapy: a European perspective using the nominal group technique. *Mary P. Tully, Ph.D.*, Judith A. Cantrill, M.Sc.; University of Manchester, Manchester, United Kingdom.

PURPOSE: Appropriate prescribing is an important aim of pharmaceutical care. However, few authors define the concept of appropriateness or present the items and domains to be included in its measurement. The purpose of this work was to develop such domains, for later inclusion in an instrument to assess appropriateness of long-term prescribing for individual patients.
METHODS: As part of an international working conference on the outcomes of pharmaceutical care (run by Pharmaceutical Care Network Europe), a panel was convened of ten pharmacists from seven European countries. The nominal group technique was used, actively splitting domain identification into separate creative and evaluative phases. Two iterations were used to achieve a consensus of ≥ 70% agreement on the importance of the items for inclusion.
RESULTS: Sixty-seven items were generated in the initial creative phase. These were discussed for clarification, similar items combined, and nine domains created containing 36 items. Further discussion concerned relative importance, and consensus was obtained that seven domains (with 18 items) should be included in the instrument. These were indication and drug choice (5 items), effectiveness (2), risks and safety (2), dosage (3), interactions (1), practical use (4), and monitoring (1). Interviews with patients and prescribers and prescription data would be used for domain operationalization.
CONCLUSIONS: This work identified preliminary domains of appropriateness of long-term prescribing, suitable for use in several European countries. Further work is required to include both the patient and prescriber viewpoints and to assess validity and reliability in a variety of practice settings and countries.

40. Detaching from a product: pharmacist reimbursement for diabetes services. *Eric J. MacLaughlin, Pharm.D.*, James J. Sterrett, Pharm.D.; Texas Tech, Amarillo, TX; Medical University of South Carolina, Charleston, SC.

PURPOSE: Objectives of this study were to: 1) identify diabetes disease state management (DSM) activities provided by pharmacists; 2) describe charges for particular services; 3) summarize methods and rates of reimbursement; and 4) identify perceived barriers to successful implementation.
METHODS: Between January 1 and January 30, 1998, questionnaires describing DSM services were faxed to 97 pharmacists nationwide providing diabetes management. Participants were initially identified via certified diabetes educator (CDE) status. Additional pharmacists were identified via referral from pharmacist CDEs.
RESULTS: Thirty-five responses (36%) were returned. Seventy-seven percent (27/35) were from pharmacists in community settings and 74% (26/35) were CDEs. DSM activities included (percentage pharmacists providing service:average charge): initial assessments (75%:$69), glucose monitor instruction (93%:$28), individual education (100%:$60), group education (64%:$37/person), foot-care (46%:$25), follow-up assessments (88%:$27), and pharmacotherapy consultations (77%:$40). When providing DSM services, pharmacists spent the majority of their time (73%) providing education. Point-of-care tests provided by pharmacists included: HbA_{1C} (10%:$21), cholesterol (19%:$19), and blood glucose (41%:$5). Primary methods of reimbursement were from patients (mean 52%) and third-parties (mean 46%). On average, the collection rate from all payers was 68%. Twenty-eight percent of pharmacists had third-party contracts. Pharmacists identified difficulties obtaining third-party reimbursement (83%) and lack of time (52%) as the greatest barriers to providing services.
CONCLUSION: Pharmacists provided a variety of diabetes DSM services. Individualized education represented the most consistent service provided. Pharmacists frequently obtained full reimbursement despite the perceived barrier regarding third-party payers. Further studies are needed to better

describe diabetes DSM services and reimbursement methods/rates across a wider range of pharmacist practitioners.

41. Patients' assessment of pharmacist smoking cessation counseling. *Patrick P. Gleason, Pharm.D.*, Amy Jones-Barlock, Ph.D., Jon Schommer, Ph.D., Frank Vitale, M.S., Gordon J. Vanscoy, Pharm.D., MBA, Randy P. Juhl, Ph.D.; University of Minnesota, Minneapolis, MN; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: To evaluate patients' assessment of pharmacist smoking cessation counseling.
METHODS: A national smoking cessation specialist certificate program designed to educate community pharmacists in brief (< 5 minute) counseling sessions began in January 1997. To become certified, the pharmacist had to complete six hours of continuing education, a written exam, and document performance of ten counseling sessions. After performing the counseling session, the pharmacist was instructed to provide patients with a postage paid postcard that contained three evaluative questions rated on a four point Likert scale and space was provided for written comments. Written comments were categorized, independently, by two authors and inter-rater reliability was assessed.
RESULTS: As of February 1999, 385 pharmacists had been certified and 647 patient responses from a potential of 3850 had been received. To the questions "How useful did you find the counseling session?" 95.8% (620 of 647) responded very useful or useful; "How likely do you think it is that the session will help you to quit smoking?" 86.7% (556 of 641) responded very likely or likely; and "How likely is it that you will return to the pharmacist for your future smoking cessation needs?" 89.2% (568 of 637) responded very likely or likely. Of the 122 written responses, 68% commented on the pharmacists' cognitive service, 8.2% on the positive experience without reference to cognitive services, 6.6% on the supportive value of a pharmacist without reference to cognitive services, 5.7% on the written materials only, 1.6% negative evaluations of the pharmacist, and 9.9% were classified as other. The inter-rater agreement was excellent with calculated $\kappa = 0.93$.
CONCLUSION: While responses were received from only 17% of the patients who were counseled, those that did respond indicated an overwhelmingly positive opinion of the services provided by the pharmacist. This indicates a very receptive audience, albeit of indeterminate size.

42. National sample of pharmacists' pharmacotherapy recommendations for smoking cessation. Amy Jones-Barlock, Ph.D., *Patrick P. Gleason, Pharm.D.*, Frank Vitale, M.S., Gordon J. Vanscoy, Pharm.D., MBA, Randy P. Juhl, Ph.D.; University of Minnesota, Minneapolis, MN; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: The frequency that pharmacists recommend pharmacotherapy and what pharmacotherapy pharmacists predominately recommend when providing smoking cessation counseling is currently unknown.
METHODS: Data to answer these questions were collected from January 1997 at the inception of the National Smoking Cessation Specialist Certification Program to February 1999. During this time 385 pharmacists were certified as smoking cessation specialists. To become certified, the pharmacist had to complete six hours of continuing education, a written exam, and document performance of ten counseling sessions. Counseling sessions were recorded on a standardized counseling feedback form and mailed back to the coordinating center. Responses to the question "What nicotine replacement product was recommended (include dosage)?" were recorded using a stratified statistical analysis. Two hundred certified pharmacists were selected from a total of 385. Each of these 200 pharmacists had submitted ten counseling feedback forms, of which, two were randomly selected for analysis for a total of 400 counseling sessions analyzed.
RESULTS: Sixty-two of 400 (15.5%) sessions resulted in no pharmacotherapy recommendations. Of the 84.5% (338 of 400) of sessions with pharmacotherapy recommendations, there were 484 specific drug and dosage recommendation (i.e., Nicoderm® CQ 21 mg patch/day for 6 weeks). The most common recommendations were for Nicoderm® CQ patches 65.3%, Nicorette® gum 17.1%, Zyban® 11.6%, Nicotrol® patches 4.0%, and < 1% each for Nicotrol® nasal inhaler, Nicotrol® oral inhaler, Habitrol® patches, and Prostep® patches.
CONCLUSION: This cohort of pharmacists frequently made pharmacotherapy recommendations during smoking cessation counseling sessions. Nicotine replacement with patch therapy was the most frequently recommended pharmacotherapy. Further analysis will be done to delineate specific combination recommendations and describe pharmacotherapy tapering treatment plans recommended.

Hematology

43. Reversal of warfarin-induced coagulopathy in hospitalized patients: performance of vitamin K administration guidelines. *Cynthia L Lackie, Pharm.D.*, Gabrial S. Zimmer, Pharm.D., Mary Anne Dannenhoffer, Pharm.D.; Kaleida Health, Buffalo, NY; State University of New York, Buffalo, NY; Clinical Pharmacokinetics Laboratory, Buffalo, NY.

PURPOSE: To assess clinical performance of a vitamin K (phytonadione) guideline for the reversal of warfarin-induced coagulopathy in hospitalized patients. The guideline followed was based on consensus recommendations from the American College of Chest Physicians.
DESIGN: Retrospective chart review
METHODS: All patients treated with a vitamin K guideline (VKG) during a 6-month period were evaluated for clinical and laboratory response. INR (international ratio) response, delays in scheduled procedures and discharges, bleeding and adverse events were evaluated. Bleeding events and warfarin resistance was compared with two other groups: patients empirically treated with 1) 10 mg; and 2) 5 mg of vitamin K.
RESULTS: Sixteen patients were treated with the VKG and all demonstrated reduction of INRs within 24 hours; however, only 28% and 72% of those with initial INRs > 6.0 had INRs less than 3.0, at 24 and 48 hours, respectively. Of the seven patients undergoing elective procedures, three required fresh frozen plasma and surgery was delayed in 38% (six) patients due to failure to adequately normalize laboratory INRs within 24 hours. Hospital discharges were delayed in 38% (six) of the VKG group versus 1% (six) in the 5 mg empirically dosed group. Warfarin resistance occurred in 37% (seven) and 71% (12) of the 5 mg and 10 mg empirically dosed groups versus 33% (five) in the VKG group. There was no difference in bleeding events.
CONCLUSIONS: Use of VKG may reduce warfarin resistance in hospitalized patients; however, slow reversal may be problematic, especially in patients awaiting surgical procedures or discharge. Further evaluation of optimal dosing of vitamin K in clinical practice is needed.

44. Comparison of activated clotting time and activated partial thromboplastin time in heparinized patients. *Maureen A. Smythe, Pharm.D.*, Sandra N. Nowak, B.S., John M. Koerber, B.S., Joan C. Mattson, M.D., Robert L. Begle, M.D., Susan J. Westley, MT (ASCP), Mamtha Balasubramanian, M.S.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

PURPOSE: To compare the activated clotting time (ACT) and activated partial thromboplastin time (aPTT) in patients receiving continuous infusion heparin.
METHODS: The study was conducted in two phases. Blood samples were collected from 102 patients in phase I and analyzed using three aPTT devices (MDA-180, Coagucheck Plus System™ [CPS] and Thrombolytic Assessment System™ [TAS]), one ACT device (Hemochron-801™) and a plasma heparin concentration (by antifactor Xa.) The purpose of phase I was to derive a therapeutic range for each instrument. Linear regression was performed to establish this range which was equivalent to a heparin concentration of 0.3 to 0.7 U/ml. In phase II, samples from 100 patients were collected and analyzed for the same four clotting time tests and a heparin concentration. The purpose of phase II was to determine the strength of the correlation of each test to plasma heparin concentrations and to compare the correlations between the ACT and each aPTT instrument. Patient care decisions regarding heparin therapy were also evaluated. Each test result was classified as therapeutic or nontherapeutic based on ranges established in phase I. Decisions were in agreement if both the ACT and the aPTT were therapeutic or nontherapeutic.
RESULTS: Correlations comparing each clotting test to the plasma heparin concentration were: r=0.72 (ACT), 0.86 (MDA), 0.79 (CPS) and 0.74 (TAS.) Significant differences were found for the MDA vs the ACT ($p<0.0095$) and the MDA vs the TAS ($p<0.025$.) Correlations comparing each aPTT device to the ACT were r=0.67 (MDA), 0.66 (CPS) and 0.68 (TAS.) Decisions based on the ACT disagreed with aPTT guided decisions in 36/97 (37%) patients using MDA, in 37/99 (37%) using CPS and 40/98 (41%) using TAS.
CONCLUSION: Correlations reveal the strongest relationship between the heparin level and the MDA derived aPTT value (lab-based instrument.) Additionally, this correlation was significantly greater than the ACT and the TAS bedside devices. Correlations of the ACT to the aPTT were similar among all aPTT instruments. Despite using a heparin concentration-based therapeutic range derived for each instrument, the ACT and aPTT tests produced different patient care decisions approximately 38% of the time.

45. Interhospital comparison of quality indicators for a pharmacist-managed anticoagulation service within a large academic health system. *Mark A. Douglass, Pharm.D.*, Alison H. Tran, Pharm.D., John W. Devlin, Pharm.D., BCPS, Eric Racine, Pharm.D.; Detroit Receiving Hospital, Detroit, MI; Harper Hospital, Detroit, MI.

PURPOSE: Pharmacists currently manage inpatient anticoagulation with intravenous heparin throughout our 7-hospital, 2000-bed health system (Pharmacotherapy 1999;19:1064-74). Although consistency of practice is promoted across the health system through standardized pharmacist-managed anticoagulation service (PMAS) policies and procedures, interhospital variability in PMAS practices may exist. We sought to compare important PMAS quality indicators between two of the largest hospitals in our health system.
METHODS: Thirty consecutive patients at each hospital (Detroit Receiving Hospital [DRH], Harper Hospital [HH]) who were prescribed intravenous unfractionated heparin and managed by the PMAS during April 1999 were

analyzed. Quality indicators compared include percentage of therapeutic activated partial thromboplastin times (aPTTs), heparin hours within therapeutic range, aPTTs above 48 seconds at 24 hours, appropriate chart documentation of each therapeutic recommendation, adverse events.
RESULTS: All quality indicators were similar between the two hospitals including therapeutic aPTTs ([HH vs DRH] 62% vs 60%, p=0.9), heparin hours within therapeutic range (68% vs 58%, p=0.4), aPTTs above 48 seconds at 24 hours (93% vs 88%, p=0.6), chart documentation (98 vs 91%, p=0.7), and adverse events (3% vs 8%, p=0.6).
CONCLUSION: Implementation of a PMAS throughout a large academic system has not lead to significant interhospital variability based on an analysis of common quality indicators. Furthermore, these results indicate that a PMAS established with appropriate policies and procedures can be expected to provide practice consistency within other large academic hospital systems as well.

46. Effect of two freeze/thaw cycles on the results of a heparin antifactor Xa assay. *John M. Koerber, B.S.*, Maureen A. Smythe, Pharm.D., Joan C. Mattson, M.D., Susan J. Westley, MT (ASCP), Jacquelyn E. Wright, MT (ASCP); William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

Guidelines published by the American College of Chest Physicians and the College of American Pathologists recommend correlating each lot of aPTT reagent to a plasma heparin concentration of 0.3 to 0.7 units/ml (by antifactor Xa assay) to obtain a therapeutic aPTT range. Since antifactor Xa assays are not part of routine care, samples are usually frozen until the time of analysis. Some laboratory handling procedures involve more than one freeze/thaw cycle.
PURPOSE: To determine the effects of two freeze/thaw cycles on a heparin antifactor Xa assay.
METHODS: Blood samples from 96 patients receiving continuous infusion intravenous heparin therapy were collected. Samples were centrifuged and an aPTT performed. The plasma was re-centrifuged and subsequently frozen at -70ºC for an average of 44.3 days (range 22 to 66 days). All plasma samples were thawed and analyzed (cycle 1) for plasma heparin concentrations (by the antifactor Xa assay) on the same day. After analysis, the plasma samples were re-frozen. Forty-four days later, the plasma was re-thawed and another antifactor Xa assay (cycle 2) was performed. Results from each antifactor Xa assay were compared by correlation and a Bland-Altman analysis (bias and limits of agreement [± SD]). Duplicate antifactor Xa assay was performed during one cycle to measure the bias of the assay.
RESULTS: Correlation between the antifactor Xa cycles (1 and 2) yielded an r value of 0.93 ($p<0.0001$). Bias and limits of agreement between cycles were 0.05 units/ml (range of -0.37 to 0.48 units/ml) and -0.19 to 0.29 units/ml, respectively. A total of 67/96 results from the second cycle were lower than the first cycle, 25/96 results were higher, and 4/96 results were identical. Bias and limits of agreement for the duplicate assays were -0.05 units/ml and -0.15 to 0.05 units/ml, respectively.
CONCLUSION: Although the correlation between the two freeze-thaw cycles was high, the limits of agreement indicate a wide disparity over that which can be accounted for by the assay itself. A second freeze/thaw cycle of plasma can significantly effect the results of an antifactor Xa plasma heparin concentration.

47. Effect of different heparin lots on the aPTT therapeutic range. *John M. Koerber, B.S.*, Maureen A. Smythe, Pharm.D., Joan C. Mattson, M.D., Susan J. Westley, MT (ASCP), Jacquelyn E. Wright, MT (ASCP); William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

The College of American Pathologists' guidelines suggest the aPTT therapeutic range be determined as the range which corresponds to a heparin level of 0.3–0.7 units/ml by antifactor Xa assay. The guidelines state that different lot numbers of heparin are likely to effect the value of the aPTT therapeutic range and suggest the range be reevaluated each time a new lot of heparin is introduced into patient care.
PURPOSE: To evaluate the effect of different lots of heparin on the aPTT therapeutic range.
METHODS: Blood samples from 95 patients receiving five different lots of continuous infusion intravenous heparin (25,000 units/500 ml, Abbott Laboratories) were collected. For each sample collected, the lot of heparin being used was noted. Samples were centrifuged at 1000 g for ten minutes and an aPTT was performed. The plasma was then re-centrifuged and subsequently frozen at -70ºC. Once all plasma samples were collected, they were analyzed for plasma heparin concentration (by antifactor Xa). Separate heparin curves were generated for each lot of heparin and the photometric readings from the antifactor Xa assay were evaluated against each individual curve. Plasma heparin levels, generated from each individual curve, were correlated with the results from the aPTT test (using Pearson's moment R correlation). The therapeutic aPTT range for each lot was derived by linear regression. Correlation coefficients, regression line slopes, and therapeutic ranges were compared between lots.
RESULTS: Correlations resulted in r values ranging from 0.87 to 0.89. Comparison of the regression line slopes revealed no statistical difference. Therapeutic aPTT ranges were 44-80, 47-84, 44-82, 48-90, 44-79 seconds.
CONCLUSION: Therapeutic ranges derived from different lots of heparin vary slightly. This data does not support the CAP guideline requiring reevaluation of the therapeutic range for each lot of heparin.

48. Exploratory study of patients beliefs, control of INR and adherence to anticoagulation regime in patients with nonrheumatic atrial fibrillation. *Marie-Claude Vanier, B.Pharm., M.Sc.*, Stuart Semple, B.Pharm. M.Sc., MRPharm.S., Adrian Hopper, M.D., Shuli Reich, Ph.D.; Université de Montréal, Montreal, PQ, Canada; Cité de la Santé de Laval, Laval, PQ, Canada; Guy's and St-Thomas NHS Trust, London, United Kingdom.

PURPOSE: This prospective cross-sectional study assessed the relationship between patient beliefs about stroke and warfarin treatment and INR control in nonrheumatic atrial fibrillation patients (NRAF) at the anticoagulation clinic of a London teaching hospital.
METHODS: Previous 12 months INR values defined the study groups: poor control = two or more INR values < 1.8 and good control = > 75% of INR values 2 to 3. A clinical pharmacist not involved in patient care conducted structured interviews using a standardized questionnaire at the clinic over a 6-week period. Spontaneous comments of patients were noted. Standard statistical analysis was used for assessment of predictive factors (logistic regression) and intergroup comparison.
RESULTS: Hand searching 1299 records identified 406 NRAF patients. Poor control criteria were met for 46 patients and good control for 110. Due to limited time, 25 poor control and 29 good control patients were interviewed. No significant difference was observed for age, demographic data or self-reported adherence. Alcohol intake was the only predictive factor for poor INR control (OR=0.74; CI 0.57-0.96; 11.6 ± 15.2 vs 3.7 ± 6.5 units/week, p=0.015). Structured questions on beliefs and knowledge were not predictive of INR control but significantly more patients in the poor control group spontaneously questioned the necessity of warfarin therapy or stated a dislike of taking medicine.
CONCLUSION: This study highlighted the detrimental effect of high alcohol intake on INR control. No relationship between patient beliefs and INR control was found. This might be due to small sample size or low sensitivity of questions, since differences were observed in spontaneous comments. This should be investigated further.

49. A comparative analysis of Coumadin® and generic warfarin. *Brian K. Plowman, Pharm.D., BCPS*, Anthony P. Morreale, Pharm.D., BCPS, Elaheh Mehdigholi, Pharm.D.; Veterans Affairs Healthcare System, San Diego, CA; University of the Pacific, Stockton, CA.

PURPOSE: To prospectively evaluate the therapeutic equivalency of AB-rated generic warfarin and brand warfarin (Coumadin®) in stable anticoagulated patients.
METHODS: Patients who were on stable chronic anticoagulation therapy (> 3 consecutive INRs within 15%), were randomized to either generic warfarin (Barr) or brand warfarin (Coumadin) in an 8-week crossover trial. Thirty-six patients, thirty-five males and one female, averaging 64 ± 10.4 years of age, on warfarin therapy for 55 ± 51.8 months, requiring a mean dose of 32.9 ± 14.5 mg per week of warfarin, with a mean initial INR of 2.60 were evaluated. At initial randomization, 18 patients were randomized to both the generic warfarin arm and to the brand warfarin arm. Of the 36 patients randomized, 14 were receiving anticoagulation for atrial fibrillation, 13 for DVT/PE, five for CVA, two for AVR and protein C/S deficiency, respectively. Weekly follow-up included fingerstick INRs, via the Coumatrak® device (DuPont), pill counts to assure compliance, and monitoring of potential side effects, not limited to hemorrhaging.
RESULTS: The mean INR for those patients initially randomized to the generic warfarin arm was 2.71 ± 0.34, in comparison, the mean INR for those patients initially randomized to the brand warfarin arm was 2.77 ± 0.53 (p=0.442). There were no differences between the two groups with respect to compliance, and no adverse events in either group.
CONCLUSIONS: Analysis of 36 patients reveals no clinical or statistical difference between brand (Coumadin) and generic (Barr) warfarin, thus offering a clinical and therapeutic alternative to brand warfarin.

50. Compliance associated with heparin titration nomogram implementation. *Deb S. Sherman, Pharm.D.*, Susan H. Clarke, M.T., Rob Valuck, Ph.D., JoAnn Lindenfeld, M.D., Kathleen A. Stringer, Pharm.D., FCCP; University Hospital, University of Colorado, Denver, CO.

PURPOSE: Heparin titration nomograms (HTN) have been shown to be superior to physician-directed unfractionated heparin (UFH) dosing. Compliance is an important factor in the effectiveness of a HTN, however, compliance has not been adequately described. This study assessed compliance as part of HTN implementation.
METHODS: In HTN study patients, UFH was prescribed as a 50 U/kg bolus and 15 U/kg/hour infusion and adjusted based on the HTN. Noncompliance was defined as dosing errors: 1) incorrect calculation of initial bolus or infusion doses; 2) > 2 hr to respond to an aPTT; and 3) incorrect reaction to an aPTT per the HTN; or laboratory errors: 1) obtaining an aPTT < 5 hours or > 7 hours after UFH initiation or rate change; or 2) aPTT ordered but not

obtained. Noncompliance rate was calculated by dividing the number of noncompliance events by the total potential HTN encounters.
RESULTS: Eleven patients were enrolled in the study with a total of 334 HTN encounters. There were 41 noncompliance occurrences for a total noncompliance rate of 12%. Laboratory errors occurred in 7% (16/244) of encounters while dosing errors occurred in 28% (25/90) of encounters. Of noncompliance events, the mean time to respond to an aPTT was 4.5 hours, range 2.25 to 10.75 hours. Fourteen aPTTs were drawn at an incorrect time. Two aPTTs were ordered but not obtained. An incorrect infusion adjustment occurred nine times and two patients experienced no errors.
CONCLUSION: While this study did not relate HTN compliance to outcome, noncompliance was frequent and may limit HTN effectiveness. The most common errors involved dosing. Increased emphasis on nurse education may be one strategy to enhance compliance.

51. Accuracy and clinical correlation of international normalized ratio testing by three point-of-care testing devices versus traditional laboratory testing. Gary L Horowitz, M.D., Janet M. Means, M.T. (ASCP), Avril Jean-Noel, M.T. (ASCP), *Toby C. Trujillo, Pharm.D.*, Carolyn Wheaton, R.N., Joan Doody, R.N; Beth Israel Deaconess Medical Center, Boston, MA; Massachusetts College of Pharmacy and Health Sciences, Boston, MA.

PURPOSE: The objective of the study was to evaluate the accuracy and clinical utility of the Coaguchek®, ProTime®, and Hemochron Jr.® point-of-care testing (POCT) devices vs standard laboratory monitoring.
METHODS: After undergoing venipuncture for INR testing, informed consent was obtained. Fingerstick samples were tested in random order using the three devices. Accuracy of results was evaluated with the paired t-test by calculating the absolute difference of each pair of POCT device and laboratory INR values. To detect a difference of 0.4 INR units with 90% power at a significance level of 0.05, 9 patients were needed. Secondary outcomes included: 1) number of POCT INR results ≥ 0.5 INR units from laboratory values; 2) number of POCT INR results that would result in a different therapeutic decision from laboratory values; 3) the error rate for each device.
RESULTS: Twelve patients were enrolled and the results are as follows: 1) absolute difference from lab INR: Coaguchek, 0.45 ± 0.26 (p=0.001); ProTime, 0.41 ± 0.19 (p=0.0002); Hemachron Jr., 0.21 ± 0.14 (p=0.65); 2) number of INRs ± 0.5 INR units from lab INR: Coaguchek, 5/10 (50%); ProTime, 3/9 (33%); Hemachron Jr., 1/11 (9%); 3) number of POCT INRs that would have changed therapeutic decision: Coaguchek, 4/10 (40%); ProTime, 4/9 (44%); Hemachron Jr., 1/11 (9%); 4) error rate: Coaguchek, 1/12 (8%); ProTime, 2/12 (17%); Hemachron Jr., 0/12.
CONCLUSION: The Hemachron Jr. is more accurate and clinically useful than the Coaguchek or ProTime POCT devices. Phase 2 will involve clinical validation of the Hemachron Jr. by the anticoagulation management service staff and results will be presented.

52. The use of low dose vitamin K to stabilize INR fluctuation during warfarin therapy. *Lisa E. Farnett, Pharm.D.*, Henry I. Bussey, Pharm.D., FCCP, Bhavin Patel, Pharm.D. candidate; University of Texas, Austin, TX; Anticoagulation Clinics of North America, San Antonio, TX; University of Texas, San Antonio, TX.

PURPOSE: Even under the best circumstances, there are patients receiving warfarin who have fluctuating INRs for reasons we cannot discern. This study was carried out to determine whether stabilization of the daily vitamin K intake could influence INR fluctuations in the most severe cases.
METHODS: We selected patients whose INRs had been fluctuating for reasons not associated with changes in diet, activity level, illness or medication changes. We offered the opportunity to try diet supplementation with vitamin K through the use of oral vitamin K dietary supplementation.
RESULTS: Eight patients were noted to have markedly fluctuating INRs. All eight agreed to try the vitamin K supplementation in tablet form. Data are available for seven patients. One patient experienced a TIA at one week and elected to discontinue the vitamin K supplementation. The INR was 3.2 at the time of the event. After dietary supplementation with vitamin K, the fluctuations in INR dampened in almost all of the patients. Overall, there was a statistically significant decrease in the standard deviation of the INR. With vitamin K supplementation, the absolute number of INRs in range increased from 17.3% to 37.4%, a relative increase of 46.3%. Allowing for small fluctuations on either side of the range, the number of INRs within ± 0.2 INR units of the range increased from 34.4% to 63.6 %, a relative increase of 54.1%.
DISCUSSION: In a small number of selected patients, supplementation with a daily dose of vitamin K markedly increased the number of INRs in range and decreased INR fluctuation.

HIV/AIDS

53. A relationship between CD_4 cell increases and indinavir maximum plasma concentrations in HIV-infected adults. *Peter L. Anderson, Pharm.D.*, Richard C. Brundage, Pharm.D., Ph.D., Thomas N. Kakauda, Pharm.D., Courtney V. Fletcher, Pharm.D.; University of Minnesota, Minneapolis, MN.

PURPOSE: The objective of this study was to investigate relationships between indinavir (IDV) plasma concentrations (C_{max}) and CD_4 responses in antiretroviral naive subjects treated with ZDV, 3TC, and IDV.
METHODS: CD_4 data were collected pre-entry, week zero, then monthly until week 56 (n=19), and every eight weeks thereafter to week 80 (n=14). An 8-hour IDV pharmacokinetic study was performed at weeks 2, 28, and 56. CD_4 endpoints were taken as an average of two or three visits. Changes from baseline to weeks 24, 52 and 80 were calculated, as was the CD_4 increase between weeks 24 and 80. Relationships were investigated by regression analyses.
RESULTS: No relationships were found from baseline to week 24. However, IDV C_{max} correlated with CD_4 increases from baseline to week 52 (r^2=0.44, $p<0.01$) and from baseline to week 80 (r^2=0.48, $p<0.01$). The increase in CD_4 cells between weeks 24 and 80 also correlated with IDV Cmax (r^2=0.53, $p<0.01$). These relationships were best described with an E_{max} model. The E_{max} for the change between baseline and week 80 was 379 cells/uL; the corresponding C_{max} was 14 µg/ml. The E_{max} for the period between week 24 and 80 was 290 cells/uL, with an EC50 of 8.3 µg/ml. C_{max} correlated more strongly with CD_4 response than either C_{min} or AUC.
CONCLUSIONS: The zero to 80 week CD_4 cell increase was significantly related to IDV C_{max}, as was the increase seen between 24 and 80 weeks. This finding suggests that both the minimum and C_{max} of IDV may be important for virologic and immunologic response to antiretroviral therapy. Supported by NIAID RO1-AI33835 and MO1-RR00400.

54. Phosphorylation patterns of zidovudine and lamivudine in human endothelial cells with and without hydroxyurea. *Eric B. Hoie, Pharm.D.*, Konstatine Manouilov, Ph.D., Timothy R. McGuire, Pharm.D.; University of Nebraska Medical Center, Omaha, NE.

PURPOSE: Endothelial cells may serve as sanctuary sites for HIV. Achieving adequate intracellular concentrations of antiretroviral drugs in endothelial cells may prove beneficial in controlling the progression of HIV. The purpose of this study was to compare the effects of hydroxyurea on the phosphorylation patterns of zidovudine (ZDV) and lamivudine (3TC) in human endothelial cells.
METHODS: Endothelial cells were pre-treated with hydroxyurea for 24 hours. Tritiated ZDV or 3TC was then added to the cells and incubated for three hours. After the supernatant was discarded, the cells were washed, and then lysed. The cell lysates were assayed for parent drug and the mono-, di-, and tri-phosphate forms of ZDV and 3TC by HPLC with radiochemical detection.
RESULTS: Hydroxyurea increased intracellular concentrations of all phosphorylated forms of ZDV and 3TC. ZDV monophosphate concentrations increased 3-fold with hydroxyurea compared to control. ZDV triphosphate concentrations increased 1.8-fold with hydroxyurea but only accounted for 4% of the total phosphate pool. The 3TC phosphorylation pattern differed from zidovudine. 3TC monophosphate increased 3.3-fold with hydroxyurea treatment while 3TC triphosphate increased 3.7-fold with hydroxyurea. 3TC triphosphate accounted for 23% of the total phosphate pool with hydroxyurea treatment.
CONCLUSIONS: Hydroxyurea increases intracellular concentrations of all the phosphorylated forms of ZDV and 3TC. 3TC displayed a more favorable phosphorylation pattern. The active form of the drug, 3TC triphosphate, increased 3.7-fold with hydroxyurea compared to a 1.8-fold increase in ZDV triphosphate.

55. Prevention of medication errors by utilizing a pharmacy admission note for HIV-positive patients. *Marisel Segarra-Newnham, Pharm.D., BCPS*, Bryan D. Volpp, M.D.; Veterans Affairs Medical Center, West Palm Beach, FL.

PURPOSE: Describe the utility of a clinical pharmacist evaluation of all HIV-positive patients on admission to provide continuity of care and decrease medication errors.
METHODS: HIV-positive patients receive a variety of medications. At our Veterans Affairs medical center, these patients are followed in the outpatient setting by the infectious diseases (ID) physician and an ID clinical pharmacist. Since March of 1999, general medicine teams admit HIV-positive patients instead of the ID service. To decrease possible medication errors and for continuity of care, the ID clinical pharmacist monitors these patients during their hospital stay. To communicate the patient's correct medication regimen, a pharmacy admission note is written. A retrospective review of notes and recommendations for a period of 6 months was conducted.
RESULTS: During the study period, 16 patients were admitted to the hospital (23 admissions). Forty-three percent of the admissions were due to an infection. The ID clinical pharmacist provided 71 recommendations (median of 3.5 per patient). Eighty-nine percent of recommendations were accepted. Forty-nine percent of the recommendations were to avoid medication errors by correcting orders based on the patient's outpatient therapy (n=35). Most common errors avoided were continuation of unnecessary therapy (37%) and medication omission (34%). The ID clinical pharmacist also provided medication education to all patients while hospitalized and made sure that proper follow-up was set up prior to discharge.
CONCLUSIONS: The use of a pharmacy admission note facilitates

communication with the admitting teams of HIV-positive patients, provides the pharmacist the opportunity to ensure continuity of care and to prevent medication errors.

56. An evaluation of *Pneumocystis carinii* pneumonia prophylaxis and vaccination status in veteran human immunodeficiency virus patients. *Sherri L. Alexander, Pharm.D.*, Ian R. McNicholl, Pharm.D.; John Cochran VA Medical Center, St. Louis, MO; St. Louis College of Pharmacy, St. Louis, MO.

PURPOSE: To evaluate *Pneumocystis carinii* pneumonia (PCP) prophylaxis regimens and vaccine administration in HIV-infected patients in accordance with the 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with HIV.
METHODS: A retrospective chart review of HIV-infected patients was conducted at the John Cochran VA Medical Center Infectious Diseases Clinic from August to November 1999. Data collected included age, race, past medical history, PCP prophylaxis regimen, type of prophylaxis, CD_4 count, viral load, and influenza and pneumococcal vaccination status.
RESULTS: A total of 140 charts were reviewed. The population included 77 (55%) African Americans, 61 (44%) Caucasians, one Hispanic and one Asian. Average age was 44.8 years. Forty-four percent of patients were receiving PCP prophylaxis. Of the patients receiving prophylaxis, 75% were receiving trimethoprim/sulfamethoxazole, 19% dapsone, 5% atovaquone and 1% pentamidine. Eighteen percent were receiving primary PCP prophylaxis and 82% were receiving secondary PCP prophylaxis. Of the patients receiving secondary prophylaxis, 20% were candidates for discontinuation in accordance with the USPHS/IDSA guidelines. Only 34% received an influenza vaccine for the 1998 season, 34% had received a pneumococcal vaccine, but only 14% had received both.
CONCLUSIONS: The majority of patients on PCP prophylaxis were receiving trimethoprim/sulfamethoxazole, the preferred regimen for prophylaxis. Based on the current guidelines, ten patients are candidates for prophylaxis discontinuation. Vaccinations were underutilized in the clinic's HIV-infected population. Greater emphasis should be placed on preventative health care for these patients.

57E. HMG-CoA reductase inhibitors for the treatment of protease inhibitor-associated hyperlipidemia. *Susan K. Chuck, Pharm.D.*, Scott R. Penzak, Pharm.D., Gregory V. Stajich, Pharm.D.; Mercer University; Grady Infectious Disease Program, Grady Health System, Atlanta, GA.

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Infectious Diseases

58. Efficacy of intravenous ciprofloxacin combined with beta-lactams for serious pseudomonal infections. *V. Dudas, Pharm.D.*, B. Koch, Pharm.D., J. Flaherty, Pharm.D.; University of California, San Francisco, CA.

PURPOSE: Combination therapy with aminoglycosides and beta-lactams is considered standard for serious pseudomonal infections, however, aminoglycosides may be less desirable in critical care settings due to associated toxicities. In vitro studies have demonstrated additive or synergistic activity with ciprofloxacin when combined with antipseudomonal beta-lactams. To date, limited clinical data are available on the use of this combination. The purpose of this study was to evaluate the efficacy of IV ciprofloxacin when given in combination with anti-pseudomonal beta-lactams in critically ill patients with documented *Pseudomonas aeruginosa* [PA] infections.
METHODS: Adult patients with pneumonia and/or bacteremia caused by PA were retrospectively evaluated between October 1995 and April 1998. Patients with prior administration of antipseudomonal agents for >72 hours and those with cystic fibrosis were excluded.
RESULTS: During this period, 37 patients were eligible for analysis, of which 70% were male, mean age: 63 years. Nineteen patients (51%) had positive cultures from lower respiratory sites, eleven (30%) had only bacteremia, and seven (19%) had positive cultures from the lungs and blood. The mean duration of ciprofloxacin/beta-lactam treatment was 12 ± 4.9 days (range 4-26 days). Mortality was 11% and 19%, at 14 and 28 days after initial positive culture, respectively. Bacteriologic eradication occurred in 43% (16/37), persistence in 24% (9/37) and in 32% (12/37) of cases the response was indeterminate. Clinical resolution occurred in 46% (17/37) of infections, while 13.5% (5/37) were considered failures and 40% (15/37) were indeterminate. No patients had ciprofloxacin discontinued due to adverse events.
CONCLUSION: Ciprofloxacin/beta-lactam combinations appear to be effective in the treatment of serious pseudomonal infections.

59E. Clinical outcome of patients with extended-spectrum beta-lactamase producing *Klebsiella pneumoniae* and *Escherichia coli* bacteremia after treatment with expanded spectrum cephalosporins. *Annie Wong-Beringer, Pharm.D.*, Nancy Lee, Pharm.D., Janet Hindler, M.T., Michael Loeloff, Ph.D., Ron Goldschmidt, Ph.D., Lisa Licata, Ph.D., Karen Bush, Ph.D.; Western University of Health Sciences, Pomona, CA; University of California Medical Center, Los Angeles, CA; The R.W. Johnson Pharmaceutical Research Institute.

Presented at the 39th Interscience Conference on Antimicrobial Agents and Chemotherapy of the American Society for Microbiology, San Francisco, CA, September 1999.

60. A prospective comparison of patients hospitalized for community-acquired pneumonia with or without prior outpatient antibiotic therapy. *Annie Wong-Beringer, Pharm.D.*, Marjan Sadeghi, Pharm.D.; Western University of Health Sciences; Cedars-Sinai Medical Center, Pomona, CA.

PURPOSE: Majority of patients with community-acquired pneumonia (CAP) can be managed in the outpatient setting. However, a subset of patients fail to respond to initial outpatient antibiotic therapy (OAT). This study aims to prospectively evaluate: 1) prescriber adherence to published guidelines for CAP; 2) drug-related factors leading to failure of OAT; and 3) the outcomes of patients hospitalized for CAP after failing OAT versus those who did not receive prior therapy.
METHODS: Concurrent chart reviews were performed in study patients admitted for CAP over a 5-month period. Patients were interviewed at initial presentation and 30-day follow up.
RESULTS: Fifty-seven adult patients were included; 17 failed OAT (G1) while 40 did not receive prior therapy (G2). Prescriber adherence to the ATS/IDSA guidelines is similar in both groups (80% overall). Half of the G1 patients experienced an adverse event to the prescribed antibiotic resulting in drug discontinuation and hospital admission. GI intolerance was the primary complaint, with the macrolide agents being the leading cause. Length of stay and cost of hospitalization did not differ significantly between G1 and G2. However, time to stability from diagnosis was longer in G1 vs G2 (14.7 vs 6.8 d, p=0.008). Most G1 patients (71%) did not return to usual activity at 30-day from initial presentation.
CONCLUSIONS: ATS/IDSA guidelines for CAP were followed in most patients. Adverse drug events are an important factor leading to hospital admission in those initially managed in the outpatient setting. Failure of outpatient management of CAP is associated with high morbidity.

61. Impact of a 24-hour stop and restricted access to automated dispensing machines upon duration of surgical antibiotic prophylaxis. *Kimberly J. Botwin, Pharm.D.*, Jeannie Chan, Pharm.D., Richard Jacobs, M.D., Bernard J. Guglielmo, Pharm.D.; University of California, San Francisco, CA.

PURPOSE: Automatic 24-hour stop dates have been found to reduce the duration of post-operative surgical antibiotic prophylaxis (SP). Automated dispensing machines (ADMs) are used on patient care units as a mechanism to facilitate drug distribution. Ready accessibility to antibiotics potentially reduces control of duration of SP. The impact of both a 24-hour stop SP and restricted ADM access upon SP duration was evaluated.
METHODS: Before and after restricted access to ADM, 150 orders were randomly selected for each of the following selected indications: SP, empiric therapy, documented infection, and those with no indication provided by the prescriber. Patient records were used to verify the true indication.
RESULTS: Prior to restricted access to ADM, SP orders (with automatic 24-hour stop), were discontinued within 24 hours in only 31% of cases; average duration for use of those continuing past 24 hours was 3.6 days. In selected indications other than SP, 82/450 orders were documented to be for SP (with no 24-hour stop); 58% were discontinued within 24 hours, significantly more often than when SP (with 24-hour stop) was selected (p=0.001); average duration was 3.5 days. After ADM restrictions, SP was discontinued within 24 hours 63% of the time, significantly more often than that observed prior to restricted ADM access (p<0.001). Mean duration for orders continued greater than 24 hours similarly decreased to 2.5 days.
CONCLUSIONS: A 24-hour stop for SP appears to incompletely reduce SP duration. Restricted ADM access significantly reduces the inappropriate duration of SP.

62. Discrepancy between broth microdilution antifungal susceptibility testing methods determined at 24 and 48 hours: comparison with Etest and time-kill studies. *Erika J. Ernst, Pharm.D.*, Robert C. Baker, Michael E. Klepser, Pharm.D.; University of Iowa, Iowa City, IA.

PURPOSE: To compare broth microdilution (BMD), Etest and time-kill methods for evaluating the activity of azole antifungal agents.
METHODS: Six isolates previously determined to display dose-dependent susceptibility or resistance azole antifungals by BMD methods were selected for study. BMD MICs were conducted using NCCLS approved standard (M-27A) recorded at 24 and 48 hours. MICs were also determined by Etest methods according to the manufacturer's instruction. Time-kill studies were conducted using RMPI media using fixed concentrations of fluconazole (10 µg/ml) and itraconazole (5 µg/ml). BMD MICs at 24 and 48 hours, Etest and log change in colony count at 24 hours versus control (log ΔCFU/ml) were compared using linear regression.
RESULTS: For all isolates, the 48-hour BMD MIC was > 128 µg/ml and > 8

µg/ml for fluconazole and itraconazole.

	Fluconazole			Itraconazole		
Isolate	Etest	BMD 24 hr	Log ΔCFU/ml	Etest	BMD 24 hr	Log ΔCFU/ml
1	0.19	2	-0.6810	0.5	0.25	-0.6746
2	0.125	0.25	-0.8461	0.25	0.03	-0.9509
3	0.125	0.25	-1.0839	0.094	0.03	-0.8202
4	0.125	0.25	-0.5738	0.023	0.015	-0.6159
5	24	16	-0.1802	1.5	0.25	-0.8862
6	0.094	0.25	-0.9566	0.125	0.03	-0.6331

The 24-hour BMD MIC, but not the 48-hour BMD MIC, was correlated with the MIC determined by Etest (r^2=0.98). The log ΔCFU/ml was better correlated with the 24-hour BMD and Etest (r^2=0.54, 0.56) than the 48-hour BMD (r^2=0.0089).
CONCLUSION: The BMD MIC read at 24 hours is more consistent with Etest and time-kill studies describing antifungal activity of azoles.

63. Comparative in vitro activity and pharmacodynamics for five fluoroquinolones against clinical isolates of *Streptococcus pneumoniae*. *Michael B. Kays, Pharm.D.*; Purdue University, Indianapolis, IN.

PURPOSE: Many clinicians refer to the newer fluoroquinolones (FQ) as "respiratory FQ" because of their increased activity against *S. pneumoniae*. Since AUC_{0-24}/MIC ratio correlates with clinical outcome and emergence of resistance, the purpose of this study was to compare the in vitro activity and AUC_{0-24}/MIC ratios for gatifloxacin (GAT), levofloxacin (LEVO), ciprofloxacin (CIP), trovafloxacin (TROV), and clinafloxacin (CLIN) against *S. pneumoniae*.
METHODS: One hundred three clinical strains of *S. pneumoniae* (54 Pen-S; 27 Pen-I; 22 Pen-R) were studied. MICs were determined for each agent by Etest, and the MIC_{50} and MIC_{90} were calculated. Pharmacokinetic variables were obtained from published literature and abstracts, and free serum concentration-time profiles were simulated for the following oral regimens: GAT 400 mg QD, LEVO 500 mg and 750 mg QD, CIP 500 mg and 750 mg q12h, TROV 200 mg QD, and CLIN 200 mg q12h. AUCs were calculated using the trapezoidal rule, and an AUC_{0-24}/MIC ratio was calculated for each individual isolate. The average AUC_{0-24}/MIC ratio was calculated by summation of the AUC_{0-24}/MIC ratio for each isolate and dividing by the number of isolates. ANOVA (Scheffe post-hoc test) was used to determine differences among agents for in vitro activity, after logarithmic transformation of MIC data, and AUC_{0-24}/MIC ratios ($p<0.05$).
RESULTS: The MIC_{50}/MIC_{90} (µg/ml) were: GAT, 0.25/0.38; LEVO, 0.75/1; CIP, 0.5/1; TROV, 0.064/0.125; CLIN, 0.064/0.094. TROV and CLIN were significantly more active than GAT, LEVO, and CIP. GAT was significantly more active than LEVO and CIP. The average AUC_{0-24}/MIC ratios for each regimen were: GAT 400 mg, 144; LEVO 500 mg, 64; LEVO 750 mg, 96; CIP 500 mg, 46; CIP 750 mg, 68; TROV 200 mg, 122; CLIN 200 mg, 152. The AUC_{0-24}/MIC ratios for GAT, TROV, and CLIN were significantly greater than all LEVO and CIP regimens ($p<0.0001$). The percentage of isolates with AUC_{0-24}/MIC ratios ≥ 30, ≥ 50, and ≥ 100, respectively, were: GAT 400 mg, 100%, 100%, 86%; LEVO 500 mg, 96%, 85%, 7%; LEVO 750 mg, 100%, 96%, 38%; CIP 500 mg, 85%, 19%, 1%; CIP 750 mg, 95%, 68%, 4%; TROV 200 mg, 100%, 94%, 50%; CLIN 200 mg, 100%, 100%, 94%.
CONCLUSIONS: For *S. pneumoniae*, the pharmacodynamics (AUC_{0-24}/MIC) of GAT, TROV, and CLIN are superior to LEVO and CIP. While the optimal AUC_{0-24}/MIC ratio for treatment of pneumococcal infections is controversial, it may be prudent to select the safest FQ that provides the greatest AUC_{0-24}/MIC ratio to maximize clinical outcome and minimize emergence of resistance.

64. Efficacy of linezolid in gram-positive infections: results from two phase II trials. *Sue K. Cammarata, M.D.*, Maureen A. McConnell-Martin, M.S., Thomas H. Oliphant, Ph.D., W. Mark Todd, M.D., Barry Hafkin, M.D., Donald H. Batts, M.D.; Pharmacia & Upjohn, Kalamazoo, MI.

PURPOSE: Linezolid, an oxazolidinone, a new class of antibacterial, is in development for infections due to gram-positive bacteria, both sensitive and resistant. The oral formulation is 100% bioavailable, permitting choice in dosage forms. Two open label phase II studies examined the efficacy of IV/oral linezolid in the treatment of community-acquired pneumonia (CAP) or skin and soft tissue infections (SSTI).
METHODS: Two trials of similar design enrolled hospitalized adult patients with CAP or SSTI. Patients received either low dose (250 mg TID or 375 mg BID) or high dose (375 mg TID or 625 mg BID) linezolid IV for at least 3 days prior to switch to PO until the end of therapy. Follow up occurred 15-28 days after end of therapy.
RESULTS: Three hundred ninety-nine patients were clinically evaluable (273 SSTI patients, 126 CAP patients), receiving on average 10 days of therapy. Three hundred thirty-six patients returned for follow up. Low dose linezolid provided clinical success in 91.5% (118/129) of clinically evaluable patients while high dose linezolid had clinical success in 95.2% (178/187) of patients, excluding indeterminate cases. *S. pneumoniae* was the predominant organism isolated in CAP. *S. aureus* was the predominant organism isolated in SSTI. Two hundred five patients were microbiologically evaluable with the microbiologic success in 91.4% (53/58) low dose linezolid microbiologically evaluable patients and 88.4% (84/95) high dose linezolid patients, excluding indeterminate.
CONCLUSIONS: Linezolid is an effective agent in treatment of gram-positive CAP and SSTI, particularly at doses of approximately 600 mg BID. With its interchangeable IV and oral formulations, linezolid offers ease in dosing with either formulation

65. An evaluation of cefepime vs ceftazidime for empiric treatment of febrile neutropenia in autologous peripheral blood stem cell transplant patients. *Ekata V. Shah, Pharm.D.*, Gloria L. Miller, Pharm.D., David J. Ritchie, Pharm.D.; Barnes-Jewish Hospital, St. Louis College of Pharmacy, St. Louis, MO.

PURPOSE: Cefepime (CFP) and ceftazidime (CTZ) are pharmacokinetically similar, IDSA-endorsed therapies for febrile neutropenia (FN). CFP 2 grams q8h is the FDA-approved dose for FN, although lower doses are employed by some institutions. This pilot study evaluated the efficacy of cefepime (CFP) vs ceftazidime (CTZ), each at a lower dose of 1 gram q8h, for empiric therapy of FN in autologous peripheral blood stem cell (PBSC) transplant patients.
METHODS: Patients were evaluated prospectively (CFP) and retrospectively (CTZ) for objective parameters of response 72 hours after antibiotic initiation and at therapy completion. Viral prophylaxis protocols were consistent in both groups. Outcomes classifications were success without therapy modification, success with therapy modification, or failure. Frequency of vancomycin addition, LOS, and mortality were also evaluated.
RESULTS: There were 51 evaluable patients (29 CFP, 22 CTZ). Mean duration of neutropenia was 8.4/8.2 days (CFP/CTZ); mean duration of treatment was 7.5/6.7 days (CFP/CTZ). Microbiologically documented infection was noted in 27/51 patients (13-CFP, 14-CTZ: p=NS). Success without modification occurred in 6 (21%)/1 (4%) with CFP/CTZ (p=NS). Success with modification was equivalent (55%) with both agents. Failure occurred in 7 (24%)/9 (41%) with CFP/CTZ (p=NS). Vancomycin was added in 19 (65%)/17 (77%) with CFP/CTZ (p=NS). Length of stay was 21 days in both groups and all patients were discharged alive.
CONCLUSIONS: CFP 1 gram q8h appears at least as effective as CTZ 1 gram IV q8h for empiric treatment of FN in PBSC transplant patients. These data support our continued use of CFP 1 gram q8h for FN.

66. In vitro assessment of therapeutic options for urinary tract infections due to ampicillin-resistant enterococci. *John C. Williamson, Pharm.D.*, David W. Craft, Ph.D., Ralph H. Raasch, Pharm.D., John D. Butts, Pharm.D.; University of North Carolina Hospitals; University of North Carolina, Chapel Hill, NC.

PURPOSE: An in vitro evaluation of antibiotic susceptibilities was performed to assess common therapeutic options for urinary tract infections due to ampicillin-resistant enterococci (ARE). A secondary objective was to determine the local incidence of ampicillin resistance in urinary enterococcal isolates.
METHODS: From July 1998 to April 1999, all enterococci isolated from urinary specimens were saved for further study. Ampicillin resistance was determined by disk diffusion. For all ARE, vancomycin, ciprofloxacin, and trovafloxacin susceptibilities were determined. Using agar microdilution testing, ampicillin MICs were determined for these isolates to make comparisons with achievable ampicillin urinary concentrations. ARE were identified to the species level on the basis of biochemical reactions.
RESULTS: A total of 310 urine samples were culture positive for enterococcus. Thirty (9.7%) unduplicated isolates were resistant to ampicillin. Nine (30%) had an ampicillin MIC of 128 µg/ml, 18 (60%) were 256 µg/ml, and three (10%) were 512 µg/ml. Nine (30%) were vancomycin-resistant enterococci, accounting for 2.9% of all isolates. All ARE were resistant to ciprofloxacin and 29 (96.7%) were resistant to trovafloxacin. A total of 27 isolates (90%) were identified as *E. faecium*. The other three were either *E. avium* or *E. raffinosus*.
CONCLUSIONS: Ampicillin resistance was commonly associated with resistance to vancomycin and fluoroquinolone antibiotics. Although the ampicillin MICs were high for ARE, achievable urinary concentrations of ampicillin may overcome the higher MICs. Ampicillin should still be considered a therapeutic option for the treatment of ARE urinary tract infections, particularly in the presence of multi-drug resistance.

67E. In vitro activities of parenteral beta-lactam antimicrobial agents against TEM-10, TEM-26, and SHV-5 derived extended-spectrum beta-lactamases. Jill A. Rebuck, Pharm.D., Paul Fey, Ph.D., Kimberly L. Bergman, Pharm.D., Mark E. Rupp, M.D., *Keith M. Olsen, Pharm.D.*; University of Nebraska Medial Center, Omaha, NE.

Presented at the 37th Annual Meeting of the Infectious Diseases Society of America, Philadelphia, PA, November 18-21, 1999.

68E. Characterization of an extended spectrum beta-lactamase outbreak in a pediatric intensive care unit solid organ transplant population. Jill A. Rebuck, Pharm.D., Paul D. Fey, Ph.D., *Keith M. Olsen, Pharm.D.*, Mark E.

Rupp, M.D.; University of Nebraska Medial Center, Omaha, NE.

Presented at the 39th Interscience Conference on Antimicrobial Agents and Chemotherapy of the American Society for Microbiology, San Francisco, CA, September 26-29, 1999.

69E. Mechanisms by which platelets and platelet microbicidal proteins mediate antibacterial effects in an in vitro endocarditis model of infection. *Renee-Claude Mercier, Pharm.D.*, Paul M. Sullam, M.D., Arnold S. Bayer, M.D., Michael R. Yeaman, Ph.D.; University of California, Los Angeles, CA; University of New Mexico, Albuquerque, NM; VA Medical Center, San Francisco, CA; University of California, San Francisco, CA.

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70. Retrospective cohort study: multivariate analysis model to estimate the impact of alcohol-related diagnoses on community acquired pneumonia outcome. *Ru-Ming Fan, Pharm.D., MPH*; Brookdale University Hospital, New York, NY.

PURPOSE: The purpose of the study is to assess the impact of alcohol abuse on length of hospital stay, intensive care unit use, and in-hospital mortality in adult patients with community acquired pneumonia. To evaluate the results and consider alcohol abuse as a comorbid factor for the development and implementation of evidence-based clinical/therapeutic guidelines.
METHOD: A retrospective cohort study was conducted at the Brookdale University Hospital and Medical Center from January 1, 1997 to September 30, 1999. A total of 1892 cases were included if patients were older than 18 years and had an ICD-9-CM principal diagnosis of community acquired pneumonia as defined by Fine, et al. Variables of interest included demographics, alcohol-related diagnosis, pneumonia severity, and comorbidity. Multivariate analysis using Wilcoxon testing, analysis of variance, and Pearson or Spearman correlating testing, as appropriate, were performed for all variables assessing the relationship with all three outcomes: length of stay, intensive care unit stay, and in-hospital mortality. Multivariate regression analysis included all variables associated with all outcomes at the $p<0.20$ level in multivariate analysis. Logistic regression was used to identify variables associated with an intensive care unit stay and with inpatient mortality. Because length of stay was skewed, log-transfer was used by linear regression model to interpret the results of significance for risk-adjusted analysis of length of stay.
RESULTS: For the 1892 community acquired pneumonia cases the mean length of hospital stay was 6.6 days, 11% of the cases had intensive care unit stay, and 10% of the cases died during hospitalization. In univariate analysis, community acquired pneumonia with alcohol related diagnosis had longer length of hospital stay (6.9 days, $p=0.02$), were more likely to experience an intensive care unit stay (14% vs 11%, $p<0.05$) and had higher in hospital mortality (12.8% vs 10%, $p<0.05$). Multivariate analysis adjusting for comorbidity, pneumonia etiology, and demographics revealed that for pneumonia cases with alcohol-related diagnoses, risk adjusted length of hospital stay was 1.8 days longer (8.3 vs 6.5 days, $p=0.01$), intensive care unit use was higher (16 % vs 11%, adjusted odds ratio 1.98, 95% confidence interval 1.68-2.96), and mortality was not statistically different (10% with or without an alcohol-related diagnosis).
CONCLUSION: Having alcohol-related diagnosis is associated with more use of intensive care and longer inpatient stays. Alcohol abuse is thought to be a risk factor for the development of pneumonia. The study results demonstrated that alcohol abuse is also a prognostic factor increasing resource utilization in community acquired pneumonia, although not mortality. These findings suggested that development of evidence-based pneumonia guidelines should consider alcohol abuse as a comorbid factor.

71. Assessment of a pilot extended interval aminoglycoside dosing protocol in intensive care unit and hematology/oncology patients. *Jeffrey R. Chalmers, R.Ph.*, Donna L. Capozzi, Pharm.D., Nicholas G. Puskas, R.Ph., Mary Beth Legere, Pharm.D., Jennifer K. Long, Pharm.D; Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: Implementation of a 5 mg/kg extended interval aminoglycoside dosing (EIAD) pilot protocol was evaluated in adult hematology/oncology (hem/onc) and medical/surgical intensive care unit (ICU) patients. Pharmacokinetic parameters from each group were assessed to determine if target levels were achieved.
METHODS: All eligible patients received 5 mg/kg based on actual/adjusted body weight once a day up to a maximum dose of 500 mg. Drug concentrations were obtained around the second dose with a target peak range of 15 to 25 µg/ml and a target trough range of < 1.0 µg/ml. The interval was extended if the trough level was between 1.1 and 3 µg/ml. Patients were removed from the protocol if the trough level was greater than 3 µg/ml. Pharmacokinetic parameters were calculated using standard equations.
RESULTS: Drug concentrations were obtained on 51 patients (29 hem/onc, 22 ICU). The mean dose was 375 mg (range 260 to 500 mg). The calculated mean peak for all 51 patients was 15.9 µg/ml (range 5.8 to 35.5 µg/ml). The mean peaks were 16.98 µg/ml (range 8.1 to 35.5 µg/ml) and 14.56 µg/ml (range 5.8 to 28.3) for hem/onc and ICU patients, respectively. Peak levels fell below the target concentration in 13/29 (45%) hem/onc and 12/22 (55%) ICU patients. Intervals were extended in 4/29 (13.8%) hem/onc and 3/22 (13.6%) ICU patients.
CONCLUSION: A high percentage of patients in both groups did not achieve peak concentrations within our targeted range. Therefore, we intend to evaluate other dosing regimens prior to hospital wide implementation of an EIAD program.

72. Formulary manipulation to control vancomycin-resistant *Enterococcus faecium*. *Debra A. Goff, Pharm.D.*, Sondra J. Sierawski, R.Ph.; The Ohio State University Medical Center, Columbus, OH.

PURPOSE: There was a dramatic increase in vancomycin-resistant *Enterococcus faecium* (VRE) infections in our institution from 1996 to 1997. We conducted a study evaluating formulary changes, annual antibiotic use, and change in VRE incidence to analyze if an association between formulary changes and the incidence of VRE exist.
METHODS: Improved infection control measures and vancomycin restrictions were implemented in 1997. In November 1997 ceftazidime (C), ceftriaxone (C), and ceftizoxime (C) were removed from the formulary as general use antibiotics and were replaced with a new, restricted use cephalosporin, cefepime (C). Piperacillin/tazobactam (P/T) use was encouraged. The use of all antimicrobials was prospectively monitored by doses dispensed monthly. Hospitalized patients with VRE, cultured from any site, were identified from the microbiology database. Patients with multiple sites were listed once. The number of doses dispensed between fiscal years were analyzed using Scheffe one-way analysis of variance.
RESULTS: Following the change in infection control measures and vancomycin restrictions, there was a decrease in the use of V and significant increase in P/T use. After the formulary change in C, there was a significant decrease in C use and a significant increase in P/T use. The number of VRE patients increased each year, while the percentage increase dropped from 152% to 12% after the formulary change.

Fiscal Year	VRE Patients	% Increase VRE	# Doses Dispensed Annually C	V	P/T	Average Daily Census
94-95	25	--	35,289	29,375	15,423	590
95-96	29	16	32,273	32,687	10,759	522
96-97	73	152	28,472	28,499	19,425*	509
97-98	97	33	15,038*	24,422	32,488*	502
98-99	109	12	10,496	24,383	43,472*	518

* $p<0.05$

CONCLUSIONS: The escalating rate of VRE infections decreased from 152% to 12% by manipulating the antibiotic formulary.

73. An impact analysis of pharmaceutical care provided by a pharmacist to patients followed by an infectious diseases consultation service. *Julie Forget, M.Sc.*, Carine Dufort, M.Sc., André Bonnici, M.Sc., David Portnoy, M.D., Murray P. Ducharme, Pharm.D.; Montreal General Hospital, Montreal, PQ, Canada; University of Montreal, Montreal, PQ, Canada.

PURPOSE: To determine whether pharmaceutical care can improve patients' health outcomes and cost-related antibiotic treatments, when a pharmacist is part of an infectious diseases consultation service or not.
METHODS: A 6-month prospective study was conducted at the Montreal General Hospital. During the first two months, an observation period took place to assess baseline values of the diverse parameters. Patients were then randomized for a 4-month period to the infectious diseases consultation service with or without a clinical pharmacist. Diverse health and economic outcomes were measured throughout the study.
RESULTS: Data coming from 147 patients were analyzed. The three patient groups had similar demographic characteristics at baseline. Variability in health outcomes were larger than expected, resulting in an appropriate statistical power to detect differences of more than 80% between groups only. Nevertheless, the presence of the pharmacist in the ID consultation service significantly decreased by 79% ($p\leq0.05$) the number of *C. difficile* superinfections cases. Significant trends were also observed on the following health outcomes: duration of follow up (24% decrease), time to normalization of white blood cell counts (51%). The pharmacist presence also appeared to decrease laboratory costs (by 15%), cost of drug level monitoring (by 24%), and cost of antibiotic treatments (by 29%).
CONCLUSION: Despite a larger than expected variability in measured outcomes, this study suggest that the presence of the pharmacist within an infectious diseases consultation service has a favorable impact on patient health outcomes and cost related to antibiotic treatments.

74. Penetration of ceftazidime administered via intermittent and continuous infusion into the pulmonary epithelial lining fluid. *Scott D. Hanes, Pharm.D.*, G. Christopher Wood, Pharm.D., Timothy D. Mandrell, DVM, Naomi Gades, DVM.; University of Tennessee, Memphis, TN.

PURPOSE: The penetration of continuous infusion antibiotics into the pulmonary epithelial lining fluid (ELF), the infectious site for pneumonia,

has not been studied. This study compared the pulmonary penetration characteristics of ceftazidime (CTZ) into the ELF when administered as an intermittent (IC) and continuous CTZ infusion (CC).
METHODS: Nine crossbred, male pigs were randomized to receive IC (20 mg/kg q8 hours) and CC (60 mg/kg/day) for 24 hours in a crossover study design with a 48-hour washout period between regimens. Serial blood and bronchoalveolar lavage samples were obtained during the 16 to 24 hour dosing interval. The ELF penetration was estimated using the CTZ AUC_{elf} /AUC_{serum} ratio and using CTZ ELF/serum concentration ratio at each sampling time.
RESULTS: CTZ penetration into the ELF was 23.9% and 30.7% (p=0.8) for CC and IC regimens, respectively, using the AUC method. Using the CTZ ELF/serum concentration ratio method, penetration varied from 12.8% to 54.8% (p<0.05) for CC therapy and from 6.9% to 79.0% (p<0.05) for IC therapy. The median ELF C_{ss} (CC), C_{max} and C_{min} (IC) were 3.9 µg/ml, 8.9 µg/ml and 2.1 µg/ml, respectively. The CTZ $t_{1/2}$ in the ELF and serum were 3.0 and 1.6 ± 0.2 hours, respectively.
CONCLUSION: CTZ ELF penetration was similar between IC and CC regimens using the AUC method. The ELF/serum CTZ ratio method was not useful secondary to the non-parallel elimination characteristics of CTZ from the ELF and serum. As a result higher CTZ ELF concentrations, IC therapy may have a therapeutic advantage in the treatment of pneumonia since many gram negative bacteria may still respond in a concentration-dependent manner at the ELF concentrations obtained.

75. Pharmacodynamics of cefepime continuous infusion and intermittent bolus against nosocomial pathogens. *David S. Burgess, Pharm.D.*, Justin K. Cheuvront, Pharm.D. candidate; University of Texas Health Science Center, San Antonio, TX; University of Texas, Austin, TX.

OBJECTIVE: To evaluate the pharmacodynamics of cefepime by continuous infusion (CI) and intermittent bolus (IB) against commonly encountered nosocomial pathogens.
METHODS: Twelve (6 M/6 F) normal healthy volunteers received cefepime by continuous infusion (4 g or 3 g) and intermittent bolus (2 g q12/hour) over 24 hours. Serum samples were collected and analyzed by HPLC. MICs were performed according to NCCLS guidelines against the following clinical isolates (number): *E. aerogenes* (13), *E. cloacae* (22), *E. coli* (28), *K. pneumoniae* (28), *P. aeruginosa* (29), *P. mirabilis* (22), *S. marcescens* (9), and *S. aureus* (29). The time above the MIC was determined for each organism against all three regimens for each volunteer. To compare maximal activity, the percentage of patients with serum concentrations above the MIC for ≥ 70% (gram-negative bacteria) or 40% (*S. aureus*) of the dosing interval for intermittent bolus and ≥ 4 x MIC for continuous infusion were compared using ANOVA with the Scheffe post-hoc test.
RESULTS: The C_{max}, C_{min}, and $t_{1/2}$ for intermittent cefepime were 140.7 ± 25.5, 1.5 ± 0.6, and 2.0 ± 0.2, respectively. The C_{ss} for 4 g and 3 g CI were 20.5 ± 2.7 and 13.7 ± 1.4 µg/ml, respectively.

			% Patients with Maximal Activity			
Organism	MIC_{50}	MIC_{90}	IB	CI (4 g)	CI (3 g)	p value
E. aerogenes	0.0625	0.25	100	100	100	NS
E. cloacae	0.0625	2	95	95	91	NS
E. coli	0.0625	0.50	100	100	100	NS
K. pneumoniae	0.0625	0.25	100	100	97	NS
P. aeruginosa	4	16	66	69	43	<0.001
P. mirabilis	0.0312	0.13	100	100	100	NS
S. marcescens	2	4	97	100	72	<0.001
S. aureus	4	4	100	93	24	<0.001

CONCLUSION: No differences exist between the total daily dose of cefepime required to maximize the pharmacodynamic parameter between modes of administration. In fact, cefepime 3 g CI per day was statistically inferior to 4 g CI or 2 g q12/hour for *P. aeruginosa*, *S. marcescens*, and *S. aureus*.

76. Appropriateness of perioperative antibiotics and incidence of postoperative infections in a community hospital. *Donna R. Burgess, R.Ph.*, Andria N. Lewis, Pharm.D., Jacque J. Snow, Pharm.D., David S. Burgess, Pharm.D.; University of Texas Health Sciences Center, San Antonio, TX.

PURPOSE: To evaluate the appropriateness, timing, and duration of pre- and postoperative antibiotics at a community hospital and compare the use of antimicrobial prophylaxis to national guidelines.
METHODS: Adult inpatients undergoing surgical procedures from July to September 1999 were identified. Data collected included: patient demographics (age, gender, height, and weight), comorbid conditions, date of surgery, type of surgery, surgeon, National Research Council wound classification, American Society of Anesthesiologists classification of physical status (ASA score), length of surgery, pre- and postoperative antibiotic regimens, time between preoperative antibiotic and start of surgery, length of antibiotic therapy, postoperative infections and treatment of infection, and any adverse drug reactions.
RESULTS: Overall, 402 (224 females and 178 males) of 538 surgical procedures performed were evaluated. The age (mean ± SD), duration of surgery (median and range), and ASA score were 57.8 ± 17.3, 90 minutes (15 to 676 minutes) and 2.3 ± 0.8, respectively. The six most common surgical procedures were: orthopedic (23%), OB/GYN (14%), ENT (9%), urology (9%), biliary tract (8%), and cardiac (7%). The majority of the cases were classified as clean-contaminated (221) followed by clean (149), contaminated (10), and dirty (6). The remaining 16 cases were not classified. The most common preoperative antibiotic was cefazolin (166 cases) followed by cefoxitin or cefotetan (65 cases); however, 89 cases did not receive any documented preoperative antibiotics. Of 313 cases, 234 (75%) had a documented time of administration of preoperative antibiotics. Of those, 49% of the antibiotics were given more than one hour prior to surgery. The postoperative infection rate was 3% and was related to the wound classification and presence of diabetes (p=0.0013). Only two adverse drug reactions were reported to antibiotic prophylaxis.
CONCLUSION: Overall, the appropriate preoperative antibiotic was utilized; however, the timing of preoperative antibiotics and duration of postoperative antibiotics were not consistent with national guidelines. This information will be utilized to educate the physicians and help standardize the use, timing, duration, and documentation of antimicrobial prophylaxis in the health system.

77. Comparison of the pharmacodynamics of levofloxacin and ciprofloxacin to new and investigational fluoroquinolones against *Streptococcus pneumoniae*. *James S. Lewis II, Pharm.D.*, David S. Burgess, Pharm.D.; University of Texas Health Science Center, San Antonio, TX; University of Texas, Austin, TX.

OBJECTIVE: The pharmacodynamic parameters that best correlate with clinical outcome for fluoroquinolones have been identified as the C_{max}/MIC and AUC_{0-24}/MIC. This study was undertaken to evaluate the pharmacodynamics of new and investigational fluoroquinolones against *Streptococcus pneumoniae*.
METHODS: The literature values for protein binding, C_{max}, and AUC_{0-24} in normal healthy volunteers were determined for the following antimicrobial regimens: clinafloxacin (CLINA) 200 mg IV q12/hour, moxifloxacin (MOXI) 400 mg PO QD, sitafloxacin (SITA) 200 mg PO QD, gatifloxacin (GATI) 400 mg IV/PO QD, gemifloxacin (GEMI) 320 mg PO QD, levofloxacin (LEVO) 750 mg PO and 500 mg IV/PO QD, ciprofloxacin (CIP) 400 mg IV q8/hour and q12/hour, and CIP 750 and 500 mg PO BID. The weighted geometric mean MIC_{90} for *S. pneumoniae* was determined for each antimicrobial agent based on published literature. The total and free C_{max}/MIC and AUC_{0-24}/MIC were calculated for each regimen.
RESULTS:

Total Drug	Total Route	Free MIC_{90}	Free C_{max}/MIC	AUC_{0-24}/ MIC	C_{max}/ MIC	AUC_{0-24}/ MIC
CLINA 200 mg	IV	0.09	29	244	28	232
MOXI 400 mg	PO	0.23	14	139	8	78
SITA 200 mg	PO	0.09	21	133	11	67
GAI 400 mg	IV	0.47	10	75	8	60
GEMI 320 mg	PO	0.05	29	186	9	56
GATI 400 mg	PO	0.47	9	69	7	55
LEVO 750 mg	PO	1.20	7	76	5	53
LEVO 500 mg	IV	1.20	5	46	4	32
LEVO 500 mg	PO	1.20	5	40	3	28
CIP 400 mg q8	IV	1.47	3	24	2	17
CIP 750 mg	PO	1.47	3	24	2	17
CIP 400 mg q12	IV	1.47	3	17	2	12
CIP 500 mg	PO	1.47	2	17	1	12

The new and investigational fluoroquinolones are more potent than LEVO or CIP against *S. pneumoniae*. The rank order (highest to lowest free AUC_{0-24}/MIC) was as follows: CLINA >>> MOXI > SITA > GATI = GEMI = LEVO 750 mg >> LEVO 500 mg >> CIPRO.
CONCLUSION: Differences exist between the pharmacodynamic parameters of the fluoroquinolones against *S. pneumoniae*, further evaluation is required to determine the bacterial and clinical significance.

Managed Care

78. Inappropriate prescribing of celecoxib in a Medicaid HMO. *Diane Ammerman, Pharm.D.*, Tracy A. Mascari, Pharm.D., Kjel A. Johnson, Pharm.D.; UPMC Health Plan, Pittsburgh, PA.

PURPOSE: To determine 1) the incidence and reasons for inappropriate prescribing of celecoxib; and 2) the cost of inappropriate prescribing in a Medicaid HMO.
METHODS: Cyclooxygenase (COX)-2 inhibitors have a lower incidence of gastrointestinal (GI) erosions and bleeding than other NSAIDs but are significantly more costly. We implemented a program to decrease inappropriate prescribing of celecoxib in a plan of 73,747 Medicaid members. Appropriate prescribing was defined as celecoxib use in patients with at least one published risk factor for GI bleeding (age > 65 years, history of ulcer or GI bleeding, chronic steroid or anticoagulant use, CHF or renal failure) or failure of multiple (≥ 3) NSAIDs. Each prescription was reviewed, and the

physician contacted to discuss clinical information. Cost savings were calculated based on AWP for celecoxib and MAC for generic NSAIDs.
RESULTS: During the first month, 264 celecoxib prescriptions were evaluated for appropriateness. One hundred twenty-seven (48%) had no risk factors for GI bleeding and used fewer than 3 NSAIDs in the past, and therefore were deemed inappropriate celecoxib use. One hundred thirty-seven (52%) members were appropriately prescribed celecoxib. Twenty-four percent were > 65 years of age, 57% had a history of ulcer disease, 15% were taking steroids, 7% were taking anticoagulants and 31% failed ≥ 3 NSAIDs. The estimated annual cost savings for this program is $90,000.
CONCLUSIONS: Approximately half of all prescriptions for celecoxib in this Medicaid population were found to be inappropriate, and implementation of this program significantly decreased NSAID costs.

Nephrology

79E. Artificial neural networks to predict erythropoietin effect on hematocrit in patients with chronic renal failure. *Alexander Goldfarb-Rumyantzev, M.D.*, John Shin, M.D., Joanna M. Rodriguez, M.D., Michael H. Schwenk, Pharm.D., Carl R. Rosenberg, Ph.D., Sonam P. Kundeling, M.D., Chaim Charytan, M.D., Bruce S. Spinowitz, M.D.; New York Hospital Medical Center of Queens, Flushing, NY.

Published in J Am Soc Nephrol 1999;10:abstract A0376.

80E. Pharmacokinetics of cefazolin during high-flux hemodialysis in patients with residual renal function. Thomas E. Drabik, D.O., Edward F. Foote, Pharm.D., *Omaira Meléndez, Pharm.D.*, Naomi V. Dahl, Pharm.D., Caroline A. Stewart, R.N., Barbara Miholics, R.N., Richard A. Sherman, M.D., John A. Walker, M.D., Toros Kapoian, M.D.; Rutgers, State University of New Jersey, Piscataway, NJ; Robert Wood Johnson Medical School, New Brunswick, NJ; DCI/RWJ Dialysis Center, North Brunswick, NJ.

Published in the J Am Soc Neph 1999;10:190A.

81. Characterization of p-glycoprotein mediated transport of famotidine in MDCK cells. *Thomas C. Dowling, Pharm.D., Ph.D.*, Chetan Karyekar, M.D., Natalie D. Eddington, Ph.D.; University of Maryland, Baltimore, MD.

PURPOSE: Many commonly prescribed organic cations (OC) undergo extensive renal tubular secretion. Some organic cations, such as cimetidine (CIM) and vinblastine, are also substrates of p-glycoprotein (P-GP) in renal cells. In a previous clinical study, tubular secretion of famotidine was not saturable over a 30-fold range of plasma concentration (Dowling, et al. J Am Soc Nephrol 1998;9:70). Thus, the purpose of this study was to investigate the role of P-GP in the renal excretion of famotidine.
METHODS: The transepithelial transport (A→B, B→A) of FAM (10 µM) and CIM (10 µM) was investigated in wild-type (WT) and MDR1 transfected (MDR) MDCK cells. P-GP activity was inhibited by PSC-833 (PSC, 0.5 µM). Integrity of monolayers (80-100 K/well) was determined by transepithelial electrical resistance on day four. Concentrations of CIM and FAM were determined by HPLC. Apparent permeability (P_{app}) was calculated by standard methods.
RESULTS: In WT, the P_{app} ratio (B→A: A→B) for CIM and FAM were 2.1 and 1.2 indicating net efflux. This efflux was significantly inhibited by preincubation with PSC. PSC also decreased P_{app} ratios for CIM (30%) and FAM (70%). Similar inhibition of net efflux of CIM and FAM by PSC was observed in MDR.
CONCLUSIONS: Transepithelial transport of cimetidine and famotidine was inhibited by PSC-833, indicating that both organic cations are substrates of P-GP. This study suggests that P-GP is involved in the tubular secretion of famotidine, which may explain previous clinical findings. Additional investigations of the role of p-glycoprotein on the renal handling of organic cations is warranted.

Neurology

82. Development and evaluation of a tool measuring the ability of stroke rehabilitation inpatients to self-medicate. *Debora W. Kwan, B.Sc.Phm., M.S.*, Shabbir M.H. Alibhai, M.D., Heather Palmer, Ph.D., Eleanor Rutledge, B.Sc.Phm.; Toronto Rehabilitation Institute, Toronto, ON, Canada; Baycrest Centre for Geriatric Care, Toronto, ON, Canada.

PURPOSE: The functional independence measure (FIM) is used to evaluate severity of disability and rehabilitation needs of our stroke rehabilitation inpatients. Medication taking is not a specific part of this. We developed and evaluated a self-medication tool (SMT) to supplement the FIM.
METHODS: The SMT was modeled after the FIM. Seven levels reflecting amount and type of assistance required for medication taking were established. Scores ranged from complete independence (maximum score: seven) to total assistance (minimum score: one). At admission and discharge, a pharmacist assigned a score to patients by observing their performance during a regular medication administration time. SMT scores were compared to total FIM scores and the cognitive section of FIM.
RESULTS: Thirty-three patients aged 69.0 ± 11.9 years (mean ± SD) participated. SMT scores were not significantly influenced by number of medications taken. At admission, 100% of patients required assistance with medication taking. SMT scores ranged from one to five (median=1). At discharge, 22% of patients were completely independent in medication taking. SMT scores ranged from one to seven (median=4.5). A modest positive correlation was seen between SMT and total FIM scores (Pearson correlation coefficient: 0.32 ($p=0.06$) and 0.64 ($p<0.001$), at admission and discharge, respectively). Correlation between the cognitive section of FIM and SMT scores were 0.47 ($p<0.01$) and 0.58 ($p<0.001$) at admission and discharge, respectively.
CONCLUSIONS: Most stroke rehabilitation patients require some degree of assistance with medication taking at discharge. SMT may complement FIM by identifying additional rehabilitation goals and influencing discharge planning. Further reliability and validity testing of the SMT are warranted.

83E. Regional cerebral blood flow measured by multiple SPECT acquisitions following a single injection of ^{99m}Tc-HmPAO with and without acetazolamide. *Jeffrey P. Norenberg, M.S.*, Michael F. Hartshorne, M.D., Amy Koerner B.S., Brian B. Roberts, M.D.; University of New Mexico, Albuquerque, NM; Veteran's Affairs Regional Medical Center, Albuquerque, NM.

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Nutrition Support

84E. Possible association between abnormal carnitine metabolism and idiopathic hyperammonemia syndrome in a leukemic patient received stem cell transplant. *Lingtak-Neander Chan, Pharm.D., BCNSP*; University of Illinois at Chicago, Chicago, IL.

Presented at the 24th Clinical Congress of the American Society for Parenteral and Enteral Nutrition, Nashville, TN, January 24, 2000.

Oncology

85. Patient specific radioimmunotherapy of non-Hodgkin's lymphoma with ^{131}I-anti-B1 antibody: pharmacokinetic dosing. *William B. Webster, Pharm.D.*, Steven J. Harwood, M.D., Ph.D., Robert G. Carroll, M.D., Alexander B. Sochet, M.D., Panee Tantranond, M.D., Michele Morrissey, B.S., Pamela Goldner, R.T.N., Sherry Deruzzo, R.T.N., Ted Fahrendorf, CNMT; Bay Pines VA Medical Center, Bay Pines, FL; University of Florida, Gainesville, FL; Nova Southeastern University, Ft. Lauderdale, FL; Mercer University, Atlanta, GA; University of Southern Florida, Lakeland, FL.

PURPOSE: To report pharmacokinetic radiotherapy dosing and the clinical experience with ^{131}I-anti-B1 antibody (iodine 131 tositumomab) in patients with relapsed or refractory low-grade non-Hodgkin's B-cell lymphoma (NHL).
METHODS: ^{131}I-Anti-B1 antibody (iodine I 131 tositumomab) is a radiolabeled murine monoclonal antibody (MAb) directed against the CD20 (B1) antigen on the B-cell surface. Both the anti-B1 MAb (tositumomab) and the radionuclide appear to contribute to this compound's anti-tumor effects. Patients with NHL are treated as outpatients with ^{131}I-anti-B1 antibody (Coulter Pharmaceutical, Inc.) in two phases. In the pharmacokinetic dose determination phase (first), the patient receives predose of 450 mg tositumomab followed immediately by 35 mg of antibody radiolabeled with a dosimetric dose of iodine-131 (~5 mCi). Whole body γ camera counts, are obtained immediately after the infusion (time zero) and on two more days in the next seven days. The radiation clearance determined by the three whole body count time points is used to calculate a patient-specific ^{131}I mCi dose to deliver the desired total body radiation dose of (75 cGy with platelets ≥ 150,000/mm^3 or 65 cGy with platelets 100,000 to 149,000/mm^3). In the second phase, the therapeutic dose is administered 7 to 14 days after the dosimetric dose. The patient again receives a predose of 450 mg of tositumomab that is followed by 35 mg of antibody radiolabeled with the pharmacokinetic-based, patient-specific, ^{131}I radiotherapeutic dose.
RESULTS: Data are reported as means ± SEM. In the past 12 months (to date 11/5/99), 15 patients have been entered into the expanded access phase IIIb study at this institution. All patients were male, 58.9 ± 2.2 (44-73) years, 87 ± 3.5 kg (59-108), none morbidly obese. Fourteen patients at enrollment had low grade NHL and one had transformed to an intermediate grade NHL. Prior to study, 64% had received three chemotherapy regimens, 29% had received two chemotherapy regimens and 7% had received one chemotherapy regimen. Rituximab had failed in 28%, and 14% had prior external radiation therapy. The mean radiation activity (mCi) administered in the treatment phase, from ^{131}I tositumomab was 104 ± 9.4 mCi. The weight-based mean ^{131}I radiation dose was 1.19 ± 0.1 mCi/kg. Comparing pharmacokinetic dosing versus weight-based, 1.19 mCi/kg, showed that 13% of the patients would have received a dose greater than the 95% CI and 13% would receive doses less than the 95% CI. One patient would have received a theoretical 114% overdose if the radiation dose was weight-based.

CONCLUSIONS: Pharmacokinetic dosing improves radiotherapy precision with ^{131}I tositumomab and is essential to accurately deliver the total body radiation cGy target dose.

86. Development and evaluation of an assessment tool to determine chemotherapy patient education comprehension. *Dawn E. Colburn, Pharm.D.*, Amy W. Valley, Pharm.D., Lisa M. Holle, Pharm.D., Nancy Hudepohl, Ph.D.; South Texas Veterans Health Care System, Audie L. Murphy Division, San Antonio, TX.

PURPOSE: Many of the adverse effects associated with chemotherapy can be minimized or avoided with patient education and early intervention. There are neither published reports of patient comprehension and retention of information provided in chemotherapy counseling, nor of the effect of education on preventing severe chemotherapy complications. This project evaluated a 10-item test that will be used to assess patient comprehension and retention of chemotherapy education by pharmacists.
METHODS: The 10-item test consists of multiple choice and true/false style questions that assess patient knowledge regarding general chemotherapy toxicity management. In addition, the test contains questions with variable answers depending upon which chemotherapy regimen the patient is receiving. The test was administered on two separate chemotherapy visits to a cohort of ten patients to determine test/re-test reliability.
RESULTS: There was a strong correlation between the test scores given for the two separate test administrations (r_s=0.82). Also, an item analysis was completed for the four test questions that evaluated non-regimen specific knowledge. A paired t-test (p=0.168) did not reveal a significant difference between the two test administrations for these general questions.
CONCLUSIONS: The assessment tool did not have significant intertest variability. While test validity cannot be established at this time, this tool can be used in our further studies evaluating patient comprehension and retention of chemotherapy patient education and the effect of education on patient outcomes. It is hoped this tool will be useful to other patient education research in cancer chemotherapy.

87E. Evaluation of NQO1 gene expression and point mutations in patients receiving mitomycin-C and irinotecan. *Jill M. Kolesar, Pharm.D.*, Lisa A. Hillman, B.S., Ronald Drengler, M.D., Lisa Hammond, M.D., Sami Diab, M.D., Sally Felton, Pharm.D., Larry Schaaf, Ph.D., Daniel D. VonHoff, M.D., John G. Kuhn, Pharm.D., Eric Rowinsky, M.D., Miguel Villalona-Calero, M.D.; University of Wisconsin, Madison, WI; Cancer Therapy and Research Center, San Antonio, TX.

Presented at the Fall 1999 AACR-NCI-EORTC International Conference on Molecular Targets and Cancer Therapeutics, Washington, DC, November, 18, 1999.

88. Irinotecan clearance is increased by concomitant administration of enzyme inducers in a patient with glioblastoma multiforme. *Kristine M. Radomski, Pharm.D.*, Amar J. Gajjar, M.D., Mark N. Kirstein, Pharm.D., Margaret K. Ma, Pharm.D., Peggy Wimmer, Pharm.D., Stephen J. Thompson, M.D., Peter J. Houghton, Ph.D., Clinton F. Stewart, Pharm.D.; St. Jude Children's Research Hospital, Memphis, TN.

PURPOSE: Irinotecan (IRN) is converted by carboxylesterase to its active metabolite SN-38 and in a separate reaction is oxidized by CYP4503A4 to the metabolite APC. We describe changes in the pharmacokinetic (PK) profile of IRN and its metabolites in a patient during and after co-administration with phenytoin (DPH) and dexamethasone (DEX).
METHODS: A 14-year old girl with newly diagnosed glioblastoma multiforme was enrolled on an institutional protocol consisting of an upfront window of IV IRN given over one hour daily for five days on two consecutive weeks every 21 days for two cycles. During cycle one, the patient received DPH 300 mg PO QD and DEX 6 mg PO QD. Serial plasma samples were collected on days one, eight, and twelve and IRN, SN-38 and APC lactone concentrations were measured by HPLC. A 4-compartment model was fit to the data by MAP-Bayesian estimation (ADAPT II). Her IRN dose was increased in response to the SN-38 systemic exposures on days one and eight. DPH was tapered and discontinued the day prior to beginning cycle two. PK studies were conducted on days one and eight of cycle two.
RESULTS:

Day	IRN Dose (mg/m^2/day)	DPH Dose (mg/day)	DEX Dose (mg/day)	IRN AUC (ng•hr/ml)	SN-38 AUC (ng•hr/ml)	APC AUC (ng•hr/ml)	IRN Clearance ($L/hr/m^2$)
Cycle 1 day 1	20	300	6	136.7	8.4	203.1	142.4
Cycle 1 day 8	40	300	6	321.4	8.9	276.2	117.7
Cycle 1 day 12	60	300	6	661.5	14.5	519.6	116.7
Cycle 2 day 1	40	–	6	429.9	12.3	378.4	91.4
Cycle 2 day 8	40	–	4	566.7	21.2	288.7	68.6

AUC=area under the concentration vs time curve for 0-24 hours

The patient experienced grade two diarrhea during both cycles of IRN.
CONCLUSIONS: This patient's IRN clearance during co-administration with DPH and DEX was 2.5-fold higher compared to that measured in other high-grade glioma patients on this study not receiving enzyme inducing agents. This effect on clearance decreased slowly over eight days after stopping DPH. These findings are presented to heighten the clinician's awareness of the potential for enzyme inducing agents to decrease SN-38 systemic exposure. Supported by NIH grant 23099 and ALSAC.

89E. ^{213}Bi-[$DOTA^0$,TYR^3] octreotide in peptide receptor radionuclide therapy. *Jeffrey P. Norenberg, M.S.*, Boudewijn J. Krenning, M.D., Inge R. Konings, M.D., Marion de Jong, Ph.D., A. Srinivasan, Ph.D., Kahan Garmestani, Ph.D., Martin W. Brechbiel, Ph.D., Larry K. Kvols, M.D.; University of New Mexico, Albuquerque, NM; Erasmus University, Rotterdam, The Netherlands; Mallinckrodt Medical, St. Louis, MO; National Cancer Institute, Bethesda, MD; Moffitt Cancer Center, Tampa, FL.

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Pediatrics

90. Comparison of the systemic effects of inhaled corticosteroids in children. *Hengameh H. Raissy, Pharm.D.*, Heather N. Cain, Pharm.D., Patricia Marshik, Pharm.D., Mark Crowly, M.D., H. William Kelly, Pharm.D., FCCP, BCPS; University of New Mexico Health Sciences Center, Albuquerque, NM.

PURPOSE: The purpose of this study was to evaluate a model to compare systemic activity of inhaled corticosteroids (ICS) given in topically equipotent doses in children.
METHODS: Systemic effects were measured by 24-hour urinary free cortisol (UFC) and morning and evening serum osteocalcin. Efficacy was monitored by morning and evening exhaled nitric oxide (eNO) and morning peak expiratory flow (PEF). Twenty-one children, 6 to 16 years old on ICS at ≥ 400 µg/day beclomethasone dipropionate (BDP) equivalent were placed on BDP for a 2-week, open-label run-in baseline period. Then, patients were randomized into a double-blind, double-dummy, crossover trial for two 3-week periods of equipotent doses of fluticasone propionate (FP) or triamcinolone acetonide (TAA) as defined by the NHLBI Expert Panel Report 2. At the end of baseline and each treatment phase patients were hospitalized for sample collection.
RESULTS: No difference was found in the last seven days of morning PEF between TAA or FP (345.2 ± 94.5 vs 353.3 ± 69.6 L/min, p=0.52). The mean log of evening eNO was significantly lower for FP than TAA (25.9 vs 35 ppb, p=0.02).

Parameters	Baseline (BDP)	FP	TAA
UFC (µg/g creatinine)	37.4 ± 34.6	33.3 ± 21.1	30.4 ± 14.4
morning osteocalcin (ng/ml)	36.8 ± 19.0	36.8 ± 20.8	37.2 ± 22.0
evening osteocalcin (ng/ml)	36.3 ± 15.3	38 ± 23.2	39.8 ± 22.5

*p>0.05 for all comparisons

CONCLUSION: There was no difference in systemic effect of BDP, TAA, and FP in equipotent medium doses of these agents. UFC and serum osteocalcin may be insensitive markers of systemic activity of ICS in medium doses.

91E. Disposition of constant-rate furosemide infusion in critically ill infants and children. *Jay F. Mouser, Pharm.D.*, Kevin R. Sweeney, Ph.D., Paul A. Kramer, Ph.D., Claire L. Hibbs, R.N., Daniel G. Fisher, M.D.; Oregon State University, Portland, OR; University of Connecticut, Storrs, CT; Connecticut Children's Medical Center, Hartford, CT.

Published in J Pediatr Pharm Pract 1999;4:214.

92E. A multicenter, randomized, comparative assessment of the palatability of oral antibiotics effective in therapy of otitis media in healthy pediatric volunteers. *Michael Toscani, Pharm.D.*, Margaret Drehobl, M.D., Jay Freed, M.D., Sylvan Stool, M.D., Kathleen J. Frenia, Pharm.D.; Center for Healthcare, San Diego, CA; Pediatric Practice, Holbrook, NY; Childrens Hospital, Denver, CO; Hastings Healthcare Group, Pennington, NJ; Rutgers College of Pharmacy, New Brunswick, NJ.

93. Accumulation of CO_2 in spacers placed inline during simulated neonatal mechanical ventilation. *Ralph A. Lugo, Pharm.D.*, James Keenan, B.S., RRT, John W. Salyer, RRT, B.S., MBA; University of Utah, Salt Lake City, UT; Primary Children's Medical Center, Salt Lake City, UT.

PURPOSE: Aerosolized albuterol is frequently administered to mechanically ventilated neonates by MDI and spacer. Spacers are often placed between the Y-piece and endotracheal tube, thereby creating mechanical dead space and increasing the potential for rebreathing CO_2. The objectives of this in vitro study were to quantify CO_2 accumulation in three spacers (ACE™, Aerochamber-MV™, and Airlife Minispacer™) during simulated mechanical ventilation of a neonate.
METHODS: The ventilated lung model consisted of a ventilator, spacer, and neonatal test lung. The ventilator delivered inspiratory gas to the test lung, which was then vented into the atmosphere. To simulate expiration, 7.1% CO_2 (PCO_2 = 48 mm Hg) was manually ventilated back through the model (and spacer) during the expiratory phase. Accumulation of CO_2 within the spacer was measured with an end-tidal CO_2 monitor for four minutes. Three tidal volumes (V_T) were studied in triplicate.
RESULTS: At V_T = 7.5 ml, PCO_2 accumulated slowly in the ACE and

Minispacer and reached a maximum of 2.3 mm Hg and 7.3 mm Hg, respectively, in four minutes. In contrast, the Aerochamber-MV reached a PCO_2 of 9.5-10.0 mm Hg by 1-1.5 minutes. A similar trend occurred with V_T = 15-ml, however higher partial pressures (10-12 mm Hg) were achieved in all spacers. At V_T = 25-ml, PCO_2 rose rapidly in all spacers with the ACE, Aerochamber-MV, and Minispacer reaching peaks of 17.2, 12.3, and 20.3 mm Hg, respectively ($p<0.05$).
CONCLUSIONS: Accumulation of CO_2 in spacers depends on V_T, spacer design and volume and is likely to be clinically insignificant for most ventilated neonates. At low V_T, the ACE accumulated the least CO_2 and at higher V_T, the Aerochamber-MV minimized the potential for CO_2 rebreathing.

94. Development of an ibuprofen population pharmacokinetic model and optimal sampling times in children with cystic fibrosis. *Amir Aminimanizani, Pharm.D.*, Christy Scott, Pharm.D., BCPS, Timothy Synold, Pharm.D., Paul Beringer, Pharm.D., BCPS; University of Southern California, Los Angeles, CA; University of North Carolina, Chapel Hill, NC; City of Hope National Medical Center, Duarte, CA.

PURPOSE: Airway inflammation plays a significant role in lung function decline in patients with cystic fibrosis (CF). Chronic ibuprofen therapy significantly reduces lung function decline when peak serum concentrations are 50 to 100 mg/L. A correlation between area under-the-curve (AUC) and anti-inflammatory activity may also be evident. The purpose of this study was to develop a pharmacokinetic (PK) model and optimal sampling times (OST) for ibuprofen dosage individualization.
METHODS: Serum concentrations were obtained from 32 children with CF at 0, 0.25, 0.5, 0.75, 1, 2, 4, and 6 hours following a single ibuprofen dose of 20 to 30 mg/kg. Compartmental population PK analysis was performed using IT2S. OST were determined using ADAPTII. Student's t-test was used for comparisons.
RESULTS: A 1-compartment model with first order absorption and a lag time best described the data, which is expressed as means ± SD.

PK Paramete	Suspension (n=22)	Tablet (n=10)	Significance
Vd (L/kg)	0.20 (0.07)	0.19 (0.11)	p=0.76
K_{el} (hr^{-1})	0.95 (0.40)	1.2 (1.0)	p=0.32
K_a (hr^{-1})	15.6 (15.9)	4.2 (3.8)	p=0.03
Lag time (hr)	0.20 (0.09)	0.47 (0.20)	p<0.0001
OST (hrs)	0, 0.25, 0.5, 3.5	0, 0.5, 1, 5.25	

mean (SD)

A preliminary validation using a subset of the original data set suggests that these models are precise and unbiased.
CONCLUSIONS: Significant differences in PK parameter values and OST indicate the necessity for distinct PK models for each dosage form. Model validation in an independent sample using a Bayesian approach is currently underway.

Pharmacoeconomics

95. Medication in a care unit for prevention and taking charge of young suicide attempters: analysis of consumption and costs. *Catherine L'Eilde-Balcon, Pharm.D.*, Valérie Le Jeune, Pharm.D., Sophie Jobard, Pharm.D., Emmanuelle Vernotte, Pharm.D., Laure Bleton, M.D., Nicole Borgnis Desbordes, Pharm.D.; University Hospital, Brest, France.

PURPOSE: In Brittany, suicide attempts have become a real problem of public health, especially among young people. With regard to this fact, a medico-psychological unit for prevention and taking charge of young suicide attempters was created at the University Hospital of Brest. Accordingly, the hospital pharmacy has provided pharmaceutical services for this new care unit since October 1998. The aim of this study is to draw up a statement of consumption and costs of drugs used, one year later.
METHODS: The analysis of the quantity and cost of drugs is extracted from the results of the assessment exercise based on one year of its operations.
RESULTS: The total budget for drugs amounts to $4010. During this year, 150 patients have been hospitalized for a whole of 237 stays: the mean pharmaceutical cost comes to $22 per stay. We note the preponderant part played by psychotropics: 67% of drug cost, 60% in quantity. Among psychotropics, anxiolytics are widely prescribed (46%) as antidepressant agents (26%). Antidepressants represent 52% of the total cost of psychotropics used, ahead of neuroleptics (29%) and anxiolytics (17%). The most consumed drug is alprazolam (20%) whereas the most costly is injectable citalopram (17% of drug budget).
CONCLUSION: These results are directly related to the characteristics of suicide attempters population: depression, anxiety are often closely connected with self-destructive behavior. This evaluation is also the opportunity of arguing with physicians about the interest of certain costly specialties.

96E. Impact of spironolactone on health-related quality of life in severe heart failure. *Jeffrey A. Johnson, Ph.D.*, Bertam Pitt, M.D., Joseph T. Tooley, Pharm.D., Alfonso Perez, M.D., Kasam Akhras, Pharm.D., University of Alberta, Edmonton, AL, Canada; University of Michigan, Ann Arbor, MI; G.D. Searle, Skokie, IL.

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97E. Pharmacoeconomic analysis of ondansetron and prochlorperazine for the management of postoperative nausea and vomiting. *Jack J. Chen, Pharm.D., BCPS*, T. Jeffrey White, Pharm.D., M.S., David G. Frame, Pharm.D.; Rush-Presbyterian St. Luke's Medical Center, Chicago, IL; Huntington Memorial Hospital, Pasadena, CA; PacifiCare Health Systems, Costa Mesa, CA.

Presented at the 1999 Midyear Clinic Meeting of the American Society of Health-System Pharmacists, Orlando, FL, December 5-9, 1999.

98. Impact of drug therapy problems on the health status of ambulatory patients with musculoskeletal disorders. *Michael E. Ernst, Pharm.D.*, Seema D. Dedhiya, M.S., Jane T. Osterhaus, Ph.D.; Outcomes Pharmaceutical Health Care Network; University of Iowa, Iowa City, IA; G.D. Searle & Co., Skokie, IL.

PURPOSE: Determine whether drug therapy problems (DTPs) impact the health status of ambulatory patients with musculoskeletal disorders (MSK), and examine if real-time health status data assist pharmacists in identifying DTPs.
METHODS: Baseline data from a 12-month, prospective, observational study of 459 ambulatory patients with MSK disorders enrolled from 12 community pharmacies were examined. Patients completed SF-36 health survey plus disease-specific questions using touch-screen technology. Using data generated from the survey, pharmacists performed interviews, documented the medication history, and identified DTPs. DTP were classified into seven categories and documented using the touch-screen technology.
RESULTS: Study population's mean age was 59 years (13.5); 69% were female. Four hundred fifty-two DTPs were identified among these patients. The following summarizes patient health status based on number of DTPs identified:

	Drug Therapy Problems		
SF-36 Scores	0	1	>1
	(n=192)	(n=168)	(n=99)
Physical component summary score (PCS)	36.2	33.6[1]	31.4[1]
Mental component summary score (MCS)	49.7	48.7	47.1[1]

[1] statistically significant ($p<0.05$) difference from group with 0 DTPs (GLM, Scheffe test)

DTPs identified were: needs additional drug therapy (31.4%), adverse drug reaction (18.1%), subtherapeutic dose (17.4%), inappropriate compliance (13.8%), wrong drug (9.8%), unnecessary drug therapy (5.7%), and supratherapeutic dose (3.8%). The majority of DTPs (58.1%) were related to MSK disorders; other disorders affected included gastrointestinal, cardiac, CNS, respiratory, and endocrine. The most common action by the pharmacist was patient education (42.7%), recommending OTC drug (21.5%), or contacting prescriber (10.3%).
CONCLUSIONS: Health status of ambulatory patients with MSK disorders is impacted by DTPs. Pharmacists can use real-time data on patient's health status to assist in identifying DTPs.

99. An economic model for determining the costs and consequences of using various treatment alternatives for managing the signs and symptoms of arthritis. *Richard A. Zabinski, Pharm.D.*, Thomas A. Burke, Pharm.D., Brian R. Kaye, M.D., George Triadafilopoulos, M.D., Daniel Pettitt, DVM, M.Sc.; Searle Pharmaceuticals, Skokie, IL; Stanford University School of Medicine, Palo Alto, CA; University of California, San Francisco, CA; Pfizer U.S. Pharmaceuticals, New York, NY.

PURPOSE: A 6-month decision analytic model compared the costs and clinical consequences of treating arthritis patients with a pre-COX-2 market-mix of treatments versus treatment with each of six treatment regimens (i.e., NSAID-alone, celecoxib, NSAID + PPI, NSAID + H2RA, Arthrotec®, or NSAID plus misoprostol).
METHODS: Probabilities of GI events were derived from pooled analyses of eight phase III clinical trials (for NSAID-alone and celecoxib) supplemented with relative risks from published clinical trials (for co-therapies). Resource use and costs were estimated using a managed care claims database, taking the payer's perspective.
RESULTS: The model revealed that the NSAID-alone treatment was associated with the lowest cost ($377 per patient per six months) followed by celecoxib ($391), NSAID + H2RA ($422), the market-mix of treatments ($437), Arthrotec ($507), NSAID + misoprostol ($643), and NSAID + PPI ($766). In terms of clinical consequences, celecoxib was associated with the fewest cases of GI-related deaths, hospitalized events, ulcers and anemia followed by NSAID + PPI, NSAID + misoprostol, Arthrotec, NSAID + H2RA, the market-mix of treatments, and NSAID-alone. The NSAID + PPI regimen was associated with the fewest cases of GI distress followed by NSAID + H2RA, celecoxib, the market-mix of treatments, and NSAID-alone/Arthrotec/NSAID + misoprostol (each resulting in an increase in the

number of cases of GI distress). Sensitivity analyses revealed that the model was most sensitive to the distribution of GI risk in the population and to the drug costs.
CONCLUSIONS: Compared to a market-mix of arthritis treatments, three of the treatments (NSAID-alone, celecoxib, and NSAID + H2RA) included in this model resulted in cost savings. Of these treatment regimens, celecoxib resulted in the fewest adverse clinical outcomes.

100E. Shorter hospital stays for angioplasty patients who receive abciximab. Maureen J. Lage, Ph.D., *Beth L. Barber, Ph.D.,* Lee Bowman, Ph.D., Daniel Ball, M.S., Mohan Bala, Ph.D.; Centocor Inc, Malvern, PA; Miami University, Oxford, OH; Eli Lilly & Co., Indianapolis, IN.

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101E. Measuring adherence with antidepressant medications: preliminary evidence of reliability and validity of a new patient self-report scale. *Kathleen M. Bungay Pharm.D.*, Ira Wilson, M.D., Mark R. Kosinski, M.A., William H. Rogers, Ph.D., David Adler M.D.; The Health Institute, New England Medical Center, Boston, MA.

Presented at the NIMH 13th International Conference on Mental Health Problems in the General Health Care Sector, Washington, DC, July 12-13, 1999.

102. Comparing hospital length of stay between linezolid and vancomycin in the treatment of methicillin-resistant staphylococci species infections: a randomized, multicenter clinical trial. *Zhiming (Jim) Li, M.D., Ph.D.*, Lionel Pinto, M.S., Henry A. Glick, Ph.D., Richard J. Willke, Ph.D., Brian E. Rittenhouse, Ph.D., Barry Hafkin, M.D.; Pharmacia & Upjohn, Kalamazoo, MI; University of South Carolina, Columbus, SC; University of Pennsylvania, Philadelphia, PA.

PURPOSE: Compare length of stay (LOS) and proportion discharged by week for patients with methicillin-resistant staphylococci species (MRSS) infections treated with linezolid to those treated with vancomycin. As the first of a new class of antibiotics called oxazolidinones, linezolid is active against gram positive bacteria sensitive or resistant to other antibiotics, and is available in bioequivalent IV and oral formulations.
METHODS: Hospitalized patients with pneumonia, skin/soft tissue infection, right-sided endocarditis, urinary tract infection, or bacteremia caused by MRSS were treated with linezolid (IV followed by optional oral, n=240) or vancomycin (IV only, n=220) in a multicenter randomized clinical trial. Patients could have up to 4 weeks of treatment followed by up to four weeks of post-treatment observation. A subsample of 254 patients (124 linezolid, 130 vancomycin) was clinically evaluable (CE). LOS was determined as the number of days between a patient's first dose of study medication and the discharge date. A Kaplan-Meier survival function was used to estimate the median LOS. The proportion of patients staying in hospital for less than 7, 14, 21, or 28 days was computed and the difference between treatment arms was tested using χ^2 test.
RESULTS:

Study Sample	Study Medication	Sample Size	Estimated LOS Median (95% CI)	% Patients with LOS less than 7 days	14 days	21 days	28 days
Intent-to-treat	Linezolid	240	13 (9-15)	29	48	59	68
	Vancomycin	220	14 (12-16)	18	43	59	68
p value			NS	0.004	0.31	0.94	0.88
Clinically evaluable	Linezolid	124	13 (9-17)	31	51	65	71
	Vancomycin	130	16 (14-19)	12	41	62	72
p value			NS	0.001	0.11	0.62	0.92

CONCLUSION: There seemed to be a trend for patients with MRSS infections treated with linezolid to have a shorter LOS, though the difference of the overall median LOS between treatments was not statistically significant. However, a significantly greater proportion of patients were discharged from hospital in the first week, possibly due to linezolid's oral availability.

103. Therapeutic interchange from high-dose calcium blocker to a fixed-dose combination product in hypertension. *Thomas L. Lenz, Pharm.D.*, Antonio P. Reyes, M.D., Richard L. Wurdeman, Pharm.D., B. Daniel Lucas, Jr., Pharm.D., Daniel E. Hilleman, Pharm.D.; Creighton University Cardiac Center, Omaha, NE.

PURPOSE: Cost is an important factor in the selection of antihypertensive therapy. A fixed-dose combination of amlodipine/benazepril (AML/BEN) may represent a cost-effective alternative to certain high-priced monotherapy products. The objective of the present study was to evaluate the outcome and costs of patients switched from high-dose calcium channel blocker (CCB) therapy to fixed-dose AML/BEN.
METHODS: A total of 75 patients were switched from amlodipine (n=25), felodipine (n=25), and nifedipine GITS (n=25) to AML/BEN. Patients had to have been receiving high doses of amlodipine (≥ 10 mg/day), felodipine (≥ 10 mg/d) or nifedipine (≥ 60 mg/d). Follow up was carried out over 6 months. Sixty-six of the 75 (88%) patients were successfully switched with maintenance of BP control and without the development of dose-limiting side effects. Reasons for treatment failure included loss of BP control in five patients and dose-limiting side effects in four patients. Side effects included cough in three patients and rash in one patient. Twenty-five control patients who remained on amlodipine, felodipine, or nifedipine were followed to assess their BP control and health care resource utilization. Only one patient suffered treatment failure in the control group due to loss of BP control. After accounting for differences in acquisition cost and switching costs (clinic visits, emergency room visits, laboratory tests, loss of productivity, patient travel), a cost savings of $263 per patient was realized in the first year. Cost savings for all 75 patients in the first year were $19,725.
CONCLUSION: Our data indicate that therapeutic interchange from selected high-dose calcium channel blockers to AML/BEN can be successfully accomplished in the majority of patients. This interchange is associated with a $263 per patient cost savings in the first year after the switch, primarily because of a lower acquisition cost with AML/BEN compared to high-dose CCB.

104. Therapeutic interchange among dihydropyridine calcium channel blockers: economic and formulary considerations. *Thomas L. Lenz, Pharm.D.*, Richard L. Wurdeman, Pharm.D., Antonio P. Reyes, M.D., Daniel E. Hilleman, Pharm.D.; Creighton University Cardiac Center, Omaha, NE.

PURPOSE: To evaluate the cost effectiveness of a therapeutic interchange from amlodipine, felodipine and nifedipine extended-release to nisoldipine in patients with stage I or II hypertension.
METHODS: Patients with stage I or stage II hypertension successfully treated with amlodipine, felodipine, or nifedipine extended release alone or with a maximum of one other antihypertensive agent were eligible to be switched to nisoldipine. Patients were randomized to be switched to nisoldipine or remain on their original therapy in an appropriate 2:1 ratio. Following the switch in therapy, patients returned to the clinic at 4-week intervals. In patients failing to maintain adequate blood pressure control on initial nisoldipine doses, dose titration was permitted at 4-week intervals to a maximum daily nisoldipine dose of 60 mg. Patients experiencing dose limiting side effects or failing to respond to 60 mg per day of nisoldipine were classified as treatment failures. A comparative cost analysis was carried out between patients switched to nisoldipine and patients remaining on their original therapy.
RESULTS: Eighty-three patients (55 men/28 women) were included in the study with 58 patients switched to nisoldipine and 25 patients remaining on their original therapy. Forty-seven of 58 (81%) patients were successfully switched to nisoldipine. Of the eleven treatment failures, six were secondary to side effects and five were secondary to a loss of blood pressure control. Of the 25 control patients, all maintained blood pressure control without the addition of other antihypertensive therapy. No control patient developed new onset adverse effects. Cost savings in the first year after the switch was $4662 or $80 per patient per year.
CONCLUSION: Therapeutic interchange from amlodipine, felodipine, or nifedipine extended-release to nisoldipine was cost effective. Therapeutic success in the switch was greater than 80%. Cost savings in the first year after the switch were modest ($80 per patient per year), but are expected to more than triple in subsequent years. Nisoldipine should be considered for formulary inclusion based on its cost effectiveness.

105. Applying evidence-based clinical practice guidelines to decrease albumin utilization. *Sondra J. Sierawski, R.Ph.;* Ohio State University Medical Center, Columbus, OH.

PURPOSE: Evidence-based clinical practice guidelines (PG) for the use of human serum albumin were developed in 1997 at our institution, but were underutilized by the cardiothoracic (CT) service for post-operative fluid resuscitation. The guidelines stated that crystalloids and nonprotein colloids should be used first and second line, respectively, followed by albumin for post-operative fluid resuscitation. The goals were to decrease albumin utilization by bringing the CT service in line with the hospital PG and decrease acquisition costs.
METHODS: During the PG annual review, CT surgeons were presented with literature to support the PG and cost projections based on 6% hetastarch replacing 5% albumin. CT patients receiving albumin and/or hetastarch before and after PG implementation were evaluated for demographics, length of stay (LOS), mortality and cost. Statistical analysis was done by χ^2 test.
RESULTS:

Mean Patient Demographics and Outcomes	Before Guidelines 6/98-8/98	After Guidelines 10/98-12/98
No. CT patients receiving albumin and/or hetastarch	193	159
Patient age	61	63
Hospital LOS	9.1	8.7
SICU LOS	2.9	2.7
Mortality	4%	6%
CT patients receiving albumin first line	83%	9%*
Monthly albumin and hetastarch costs	$23,760	$6752

*statistically significant change ($p<0.05$)

CONCLUSIONS: No significant changes in patient LOS or mortality were documented. We were able to significantly decrease the number of patients

receiving albumin first line and decrease cost by $17,000/month. Cardiothoracic surgeons continue to use 6% hetastarch in place of 5% albumin and have sustained these cost savings over a 9-month period.

106. Cost justification of an indigent care sample drug procurement program. *Katie J. Suda, Pharm.D.*, Buddy R. Branson, D.Ph., David A. Kuhl, Pharm.D., Bedford L. Sorrell, Richard L. Nance, D.Ph., BCNSP; Baptist Memorial Health Care, Memphis, TN.

PURPOSE: Provision of outpatient medications to uninsured patients financially impacts many health care systems. This project assessed the effect of a pharmacist-technician medication procurement program for an outpatient indigent clinic in a university-affiliated private institution.
METHODS: Retrospective data obtained when sample drug procurement was negligible (June - November 1998) was compared to prospective data collected after initiating the program (March - August 1999). A technician was added to work with the pharmacist to obtain sample medications through pharmaceutical companies' indigent care medication programs. Current medications dispensed were matched with available medication programs. Data collection included: number of prescriptions filled per month, cost of medications purchased for the clinic each month and the calculated value of the acquired samples. Costs were calculated using hospital acquisition cost. Cost per prescription was calculated by dividing the dollar amount of medications purchased each month by the corresponding number of prescriptions. Differences between groups were assessed using a paired t-test.
RESULTS: Number (mean ± SD) of prescriptions were 1728 ± 736 and 3261 ± 308 per month in the retrospective and study groups, respectively (p=0.002). Medications purchased for the clinic decreased from $35,125 ± 5942 to $24,917 ± 5495 per month (p=0.07). Mean cost per prescription decreased from $23.58 ± 8.28 in the retrospective group to $7.71 ± 1.86 during the program (p=0.005). Value of sample medications obtained during the six months was $469,277 accounting for 75.8% of medications dispensed. Costs encountered by adding a technician were $15,250 during the same period.
CONCLUSION: A pharmacist-technician directed indigent medication program decreases medication procurement costs and cost justifies added technical support. Efforts are ongoing to expand this service.

107. Development of an economic model to assess costs and outcomes associated with dry eye disease. *Jeffrey T. Lee, Pharm.D.*, Christopher W. Teale, B.S. (Hons), MORS; Advanced Health Outcomes, Inc., Franklin, TN; Allergan Ltd.

PURPOSE: This abstract describes development of an economic model to assess costs and outcomes associated with management of dry eye disease and the range of cost offsets that may be realized with more effective therapy.
METHODS: A Markov model was populated with data from multiple sources to simulate overall costs and outcomes associated with dry eye disease. Epidemiological data were estimated from the literature. Delphi panels, third party databases, clinical trial data, physician and patient surveys were used to define current treatment patterns, disease progression, outcomes, resource utilization and costs. The model was constructed to accommodate differing perspectives and provider specifications. It provides outputs estimating system budget impact and outcomes achieved in a 1- and 3-year period, and can evaluate the effects of new treatments on these parameters.
RESULTS: Current treatment options for dry eye include artificial tears, punctal plugs, and surgery. Estimated annual costs are $456,900 (excludes artificial tears) for an organization covering 500,000 lives. The primary cost drivers are disease severity, rate of disease progression, ophthalmologist visits and plug insertion. The model estimates that introduction of a more effective drug therapy reduces non-drug direct medical costs by as much as 44% due to reduction in physician visits and plug insertion.
CONCLUSIONS: This model provides a useful framework for assessing the costs and treatment outcomes for dry eye, which allows quantitative assessment of the impact of new treatments on system budgets. Analyses suggest a more effective intervention for dry eye could decrease demand for additional specialty visits and procedures.

108. Clinical pharmacy services, pharmacy staffing, and the total cost of care in U.S. hospitals. *C.A. Bond, Pharm.D., FASHP, FCCP*, Cynthia L. Raehl, Pharm.D., FASHP, Todd Franke, Ph.D.; Texas Tech University Amarillo, TX; University of California at Los Angeles, Los Angeles, CA.

PURPOSE: This study evaluated the associations between clinical pharmacy services, pharmacy staffing, and total cost of care in U.S. hospitals.
METHODS: A database was constructed from the American Hospital Association's *Abridged Guide to the Health Care Field* and the National Clinical Pharmacy Services database. A multiple regression analysis, controlling for severity of illness, was employed to determine the associations.
RESULTS: Study population =1016 hospitals. Six clinical pharmacy services were associated with lower total cost of care: drug use evaluation (p=0.001), drug information (p=0.003), adverse drug reporting monitoring (p=0.008), drug protocol management (p=0.001), medical rounds participation (p=0.001), and medication admission histories (p=0.017). Two services were associated with higher total cost of care: TPN team participation (p=0.001) and clinical research (p=0.0001). Additionally, as staffing increased for hospital pharmacy administrators (p<0.0001) and clinical pharmacists (p=0.007) total cost of care decreased. As staffing increased for dispensing pharmacists, the total cost of care increased (p=0.006)). Total cost of care per hospital per year were lower when six clinical pharmacy services were present: drug use evaluation $1,119,810.18 (a total of $1,005,589,541.64 for the 898 hospitals offering this service); drug information $5,226,128.22 (a total of $1,212,461,747.04 for the 232 hospitals offering this service); adverse drug reporting monitoring $1,610,841.02 (a total of $1,101,815, 527.68 for the 684 hospitals offering this service); drug protocol management $1,729,608.41 (a total of $614,010,985.55 for the 355 hospitals offering this service); medical rounds participation $7,979,720.45 (a total of $1,212,917,508.41 for the 152 hospitals offering this service); and medication admission histories $6,964,145.17 (a total of $208,924,355.10 for the 30 hospitals offering this service). Clinical research $9,558,788.01 (a total of $1,013,231,529.06 for the 106 hospitals offering this service) and TPN team participation $3,211,355.12 (a total of $1,027,633,638.43 for the 320 hospitals offering this service) were associated with higher total cost of care.
CONCLUSION: The results of this study suggest that increased staffing levels of clinical pharmacists and pharmacy administrators, and some clinical pharmacy services are associated with reduced total cost of health care in U.S. hospitals.

Pharmacoepidemiology

109. Medications associated with the development of gastroesophageal reflux disease. *Julie M. Johnson, Pharm.D.*, Rex W. Force, Pharm.D., BCPS, Craig Kelley, B.S., Paul Cady, Ph.D., Vaughn Culbertson, Pharm.D., Wendy Force, R.Ph.; Idaho State University, Pocatello, ID.

PURPOSE: To examine medication use associated with a new diagnosis of gastroesophageal reflux disease (GERD).
METHODS: Medications with evidence of causing GERD (nitrates, calcium channel blockers [CCB], theophylline, beta-agonists) were identified by literature review. A retrospective case control study was then conducted utilizing a computerized Medicaid database of prescription and diagnostic information. Cases were defined as patients with a new diagnosis of GERD and a prescription claim for new anti-GERD therapy (H_2-antagonist, proton pump inhibitor, sucralfate) filled ten days prior to 30 days following GERD diagnosis. Control subjects were randomly selected after matching case patients by gender, age (± 1 year), and total number of unique medications (± 2) during the study period. Controls did not have a GERD diagnosis or therapy. For the two groups, Medicaid eligibility was documented for the preceding six months and drug use was determined by paid prescription claims within 42 days prior to case GERD diagnosis date. Odds ratios were calculated.
RESULTS: Nine hundred seventy-three cases were matched to 3564 controls (1:3.7). CCB (69/973 vs 204/3564, OR 1.26 [95% CI: 0.95-1.67]) and theophylline (26/973 vs 63/3564, OR 1.53 [95% CI: 0.96-2.41]) use was not more common in the case group, however diltiazem was (22/973 vs 40/3564, OR 2.04 [95% CI: 1.22-3.41]). Nitrates (32/973 vs 64/3564, OR 1.86 [95% CI: 1.22-2.84]) and beta-agonists (92/973 vs 222/3564, OR 1.57 [95% CI: 1.22-2.02]) were associated with new GERD.
CONCLUSIONS: New GERD was associated with diltiazem, nitrate, and beta-agonist use in a Medicaid population. Patients presenting with GERD should be evaluated for medications that may contribute to this disease.

110. Pneumococcal immunization practice: evaluation and improvement at a county health and hospital system. *Phoebe Y. Li, Pharm.D.*, Keith A. Posley, M.D., Sonja Kaubisch, Pharm.D.; Santa Clara Valley Health System, San Jose, CA; University of Pacific, Stockton, CA.

PURPOSE: This study is to 1) evaluate pneumococcal vaccine (PVX) immunization rate in high risk adult patients; 2) determine compliance with the 1997 recommendation from the Advisory Committee on Immunization Practices (ACIP); and 3) improve vaccination practice where indicated.
METHODS: Over a 6-week period, adult medicine patients were randomly selected for prospective chart review and all splenectomy patients over a 4-year period were evaluated for PVX compliance. A 3-part standardized form was designed incorporating vaccination history, vaccination indications, and a "Dear Dr." notification for intervention. Data were collected and appropriate recommendations were given to the patients' physician.
RESULTS: Preliminary data showed indication for PVX in 70% of the 400 medicine patients for whom records were screened. Of the patients with indications for PVX, 30% had no vaccination documented. Patients age ≥ 65 years old were more likely to have a current PVX. Pharmacy recommendations were successful in 75% of the patients requiring vaccination, excluding those patients who failed the clinic appointments or refused vaccination. Among the 68 splenectomy patients reviewed, 75% of the patients received PVX; however, only 28% of the patients had vaccination documented in the vaccine record.
CONCLUSION: Opportunities to improve pneumococcal immunization exist particularly in patients age < 65, or with emergency splenectomy. A clinic-

based screening tool may be useful for identifying patients requiring vaccination. Also better inpatient and outpatient documentation in the vaccine record is needed to facilitate the screening process.

Pharmacokinetics/Pharmacodynamics

111. Methylprednisolone population kinetics in patients with acute respiratory distress syndrome. *Charles R. Yates, Pharm.D.*, Alexander Vysokanov, Ph.D., Arnab Mukherjee, Ph.D., Tom Ludden, Ph.D., Elizabeth Tolley, Ph.D., Umberto Meduri, M.D., James T. Dalton, Ph.D.; University of Tennessee, Memphis, TN; Parke-Davis, Ann Arbor, MI; GloboMax LLC, Hanover, MD.

PURPOSE: This study was designed to: 1) characterize methylprednisolone (MP) disposition in a population of patients with acute respiratory distress syndrome (ARDS); and 2) determine to the extent that interpatient variability in MP pharmacokinetics contributes to differences in patient response.
METHODS: This study was a randomized, double-blind, placebo-controlled, continuous IV infusion dose study of methylprednisolone sodium succinate in 20 patients diagnosed with ARDS. The computer program NONMEM (nonlinear mixed-effect model) was used to obtain population estimates of methylprednisolone (MP) volume (Vd) and clearance (CL). MP plasma concentrations were measured by HPLC. Ultrafiltration was used to determine unbound fraction of MP.
RESULTS: In the final regression equation CL was modeled as a function of time using a sigmoid E_{max} model. Predictions of Vd and CL were not improved by any of the covariates analyzed. Final population estimates were as follows: $CL_{initial}$ = 13.2 L/hour, CL_{max} = 27.6 L/hour, T_{50} = 43.5 hour, γ (Hill coefficient) = 3.75, and Vd = 137 L. Plasma protein binding of 6α-methylprednisolone averaged 53% in ARDS patients.
CONCLUSIONS: The pharmacokinetic model presented should prove useful in helping to determine individual MP response and provide insights into the mechanisms responsible for altered kinetics of hepatically metabolized drugs in the critically ill patient.

112. Antibiotic removal on continuous veno-venous hemodialysis. Lawrence J. Lambrecht, Pharm.D., BCPS, *Brent W. Gunderson*, Wendy L. St. Peter, Pharm.D., FCCP, BCPS, Suzanne K. Swan, M.D.; Total Renal Research, Inc., Minneapolis, MN; University of Minnesota, Minneapolis, MN.

PURPOSE: This study was designed to characterize the pharmacokinetic profile of vancomycin, imipenem and ceftazidime in patients undergoing continuous veno-venous hemodialysis (CVVHD).
METHODS: Twelve intensive care patients with acute or chronic renal failure on CVVHD (blood flow rate, 200 ml/min, dialysis inflow rate, 1500 ml/hr, Renal Systems Renaflo HF 700 Hemofilter®) were given vancomycin, imipenem, and ceftazidime as clinically indicated alone or in combination. Antibiotic blood and dialysate concentrations were analyzed to determine total body clearance (CL_t), dialysis clearance (CL_d), volume of distribution (V_d), elimination rate constant (k), and elimination half-life ($t_{1/2}$).
RESULTS: Vancomycin concentrations were determined with validated EMIT assays, while imipenem and ceftazidime concentration were determined by validated HPLC. Pharmacokinetic parameters were calculated assuming a linear, one-compartment model for each antibiotic (r^2 range for individual subject concentration-time regression data, 0.943-0.999). Mean (± SD) pharmacokinetic results are as follows:

	CL_t (ml/min)	CL_d (ml/min)	V_d (L/kg)	k ($hours^{-1}$)	$t_{1/2}$ (hours)
vancomycin (n=6)	35.7 ± 8.5	22.3 ± 6.1	0.80 ± 0.06	0.028 ± 0.008	27.2 ± 8.6
imipenem (n=4)	183.2 ± 23.2	11.6 ± 0.3	0.73 ± 0.32	0.20 ± 0.05	3.5 ± 0.7
ceftazidime (n=4)	31.3 ± 10.2	20.0 ± 4.2	0.33 ± 0.10	0.06 ± 0.01	11.9 ± 2.2

CONCLUSION: These data show CVVHD contributes significantly to total body clearance of vancomycin and ceftazidime necessitating shorter dosage intervals compared to conventional hemodialysis (HD). Although imipenem dialysis clearance is a small fraction of total body clearance in CVVHD, more frequent dosing may be required compared to conventional HD.

113. Tumoral pharmacokinetics of platinum anticancer drugs in solid tumors. *Deepak Anand, Ph.D.*, Walter Wolf, Ph.D.; University of Southern California, Los Angeles, CA; Skilled Care Pharmacy, Monrovia, CA.

PURPOSE: Information about drug pharmacokinetics at the tumor site is critical to make accurate decisions about the effectiveness of therapy. The use of ^{195}mPt-cisplatin allows estimation of the time course of intratumoral cisplatin (CP) and of its metabolites in tumors, following radiopharmacokinetic analysis of detectable ^{195}mPt using gamma camera imaging.
METHODS: The kinetics of CP was measured using dynamic scintigraphic imaging. Sprague-Dawley rats bearing the Walker 256 adenocarcinoma were injected with an IV bolus dose of 6 mg/kg body weight CP. Serial images were collected for the first 45 minutes then at 60, 90, 120 and 240 minutes. Integration of the region of interest (tumor) was accomplished using external localization. Blood samples were collected and fractionated into the free and bound drug at 5, 15, 30, 60, 120 and 240 minutes.
RESULTS: There is rapid elimination of free CP from blood and an initial uptake and limited clearance of free CP from the tumor. A 3-compartment model was used to estimate free circulating CP, free tumoral CP and the intratumoral platinated anabolites: DNA, nucleoplasmic and cytoplasmic proteins. There is excellent correlation between these intratumoral estimates and validative measurements performed following tumoral excision and subcellular fractionation. The results indicate that the kinetics of CP in the tumor is extremely rapid, with platination of cytoplasmic and nuclear fractions occurring in the early phases following drug administration.
CONCLUSION: Noninvasive quantitation of ^{195}mPt using ^{195}mPt-cisplatin can determine the extent of CP targeting and estimate how much of the targeted drug is present in its pharmacologically active form.

114. Fludarabine pharmacokinetics following subcutaneous and intravenous administration in patients with lupus nephritis. *Grace Kuo, Pharm.D.*, Aaron H. Burstein, Pharm.D., Cheryl Yarboro, R.N., Frank Pucino, Pharm.D., Dimitrios T. Boumpas, M.D.; University of Houston, Houston, TX; National Institutes of Health, Bethesda, MD.

PURPOSE: To compare the pharmacokinetics (PKs) of subcutaneous (SC) and intravenous (IV) fludarabine in patients with lupus nephritis.
METHODS: Fludarabine 30 $mg/m^2/d$ was administered either SC or as a 0.5-hour IV infusion for three consecutive days to five patients with lupus nephritis in an open-label, randomized, crossover study conducted in conjunction with a phase I-II trial. All patients received PO cyclophosphamide $0.5g/m^2$ on day one of each cycle. Plasma samples were collected prior to and 0.5, 1, 1.5, 2, 4, 6, 8, and 24 hours following the first dose. Urine was collected in 6-hour increments for 24 hours. Plasma and urine were analyzed for F-ara-A by HPLC. Noncompartmental techniques were used to determine C_{max}, T_{max}, k_{el}, $t_{1/2}$, AUC_{0-24}, and AUC_{inf}. Comparison of PKs between SC and IV was by a paired Student's t-test.
RESULTS: PKs (mean ± SD) for SC and IV were:

	C_{max} (mg/L)	T_{max} (h)	k_{el} (h^{-1})	$t_{1/2}$ (h)	AUC_{0-24} (mg•h/L)	AUC_{inf} (mg•h/L)
SC	0.88±0.95	1.5±0.71	0.09±0.01	8.03±1.13	5.03±1.40	5.77±1.69
IV	0.72±0.20	0.6±0.22	0.08±0.02	8.99±2.50	3.81±0.80	4.47±0.97

Renal clearance and the percentage of dose excreted in urine for SC and IV administration were 3.03 ± 2.02 and 3.73 ± 1.25 L/h, 26 ± 12 and 26 ± 13%, respectively. No significant differences were detected between SC and IV groups. No injection site reactions were seen with SC dosing.
CONCLUSIONS: SC and IV fludarabine have similar PKs in patients with lupus nephritis. SC injection of fludarabine may be considered as an alternate route of administration.

115E. Glucocorticoid pharmacokinetics and osteoporosis in female renal transplant recipients. *R.J. Fountaine, Pharm.D.*, K.A. Reed, Pharm.D., K.K. Gilliland, Pharm.D., A.M. Ciminelli, Pharm.D., J. Hom, M.D., R.C. Venuto, M.D., K.M. Tornatore, Pharm.D.; University at Buffalo; Erie County Medical Center, Buffalo, NY.

Presented at the 101st Annual Meeting of the American Society for Clinical Pharmacology and Therapeutics, Los Angeles, CA, March 15-17, 2000.

116E. 5-Fluorocytosine: population pharmacokinetic model development, nonparametric bootstrap validation and dosing strategy evaluation. *Paul J. Williams, Pharm.D., M.S.*, Yong Ho Kim, M.S., Ene I. Ette, Pharm.D., Ph.D., James R. Lane, Pharm.D., Mei-Jen Liu, Ph.D., Edmund Capparelli, Pharm.D.; University of the Pacific, Stockton, CA; University of California at San Diego, San Diego, CA; Vertex Pharmaceutical Corp., Boston, MA; Trials by Design LLC, Stockton, CA.

Presented at the Annual Meeting of the American Association of Pharmaceutical Scientists, New Orleans, LA, November 16, 1999.

117E. A physiological pharmacokinetic model for beclomethasone dipropionate delivered via conventional metered dose inhaler and Spiros®, an investigational dry powder inhaler. *Shawn A. Scranton, Pharm.D.*, Guenther Hochhaus, Ph.D., Leigh M. Vaughan, Pharm.D., Malcolm Hill, Pharm.D.; University of Florida, Gainesville, FL; Dura Pharmaceuticals, Inc. San Diego, CA.

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118. In vivo pharmacodynamics of liposomal amphotericin B against *Candida albicans* in a neutropenic murine lung infection model. *Holly L. Hoffman, Pharm.D.*, Russell E. Lewis, Pharm.D., Erika J. Ernst, Pharm.D., Steve Piscitelli, Pharm.D., Thomas Walsh, M.D., Richard Quintiliani, M.D., Michael E. Klepser, Pharm.D.; University of Iowa, Iowa City, IA; University of Houston, Houston, TX; National Institutes of Health, Bethesda, MD; Hartford Hospital, Hartford, CT.

PURPOSE: Compare the in vivo activity of escalating doses and multiple dosing regimens of amphotericin B (L-AmB) in a neutropenic murine lung infection model.

METHODS: Swiss-Webster mice (20-24 g) were made neutropenic with cyclophosphamide 150 mg/kg on day -4 and day -1 prior to infection. Mice were infected via intratracheal inoculation with a standardized suspension of *Candida albicans* (ATCC 90028) that resulted in a starting inoculum of approximately 1 x 10^6 CFU/gram of lung tissue (GLT). Twelve hours after infection, mice were treated intravenously with escalating daily doses of L-AmB (5, 15, 20, 25 and 30 mg/kg/day) divided in four different regimens (q4, 8, 12 and 24 hours). At selected timepoints (0, 12 and 24 hours) mice were sacrificed, lungs were aseptically removed, homogenized and serial dilutions were plated on potato dextrose agar for colony count determination. Plots were constructed with log change in CFU/GLT from the starting inoculum.
RESULTS: L-AmB as a single daily dose reduced fungal burden by 1.65 $\log_{10}$ after 24 hours with 5 mg/kg, whereas 30 mg/kg reduced 2.7 $\log_{10}$. L-AmB divided into q4h dosage intervals produced a 1.6 $\log_{10}$ decrease with 30 mg/kg/day compared to no decrease in CFU/GLT for 5 mg/kg/day.
CONCLUSIONS: L-AmB given as a higher single daily dose (20-30 mg/kg/day) resulted the greatest reduction of fungal burden compared to lower or divided regimens in this model. Escalating L-AmB doses to improve efficacy appears to be well tolerated in mice and warrants further investigation in the treatment of systemic fungal infections.

119E. Dose-response of inhaled albuterol during nocturnal bronchospasm. Leslie Hendeles, Pharm.D., Richard Aherns, M.D., William Clarke, Ph.D., Pierre Geoffroy, M.D., Richard Lalonde, Pharm.D., *Leigh M. Vaughan, Pharm.D.*, Malcolm Hill, Pharm.D.; University of Florida, Gainesville, FL; University of Iowa, Iowa City, IA; Phoenix International Life Sciences, Montreal, PQ, Canada; Dura Pharmaceuticals, Inc. San Diego, CA.

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Psychiatry

120. An assessment of patients' awareness and attitudes towards antipsychotic drugs after switching from typical to atypical antipsychotic drugs. *Jane L. Tran, Pharm.D.*, Glen L. Stimmel, Pharm.D., Mary A. Gutierrez, Pharm.D.; University of Southern California, Los Angeles, CA.

PURPOSE: This study assessed awareness and attitude of patients who had been switched from typical to atypical antipsychotic drugs in looking for better tactics on counseling patients about antipsychotic drugs.
METHODS: A verbal questionnaire assessed patients' awareness of the differences between the old and new medication in regard to efficacy, side effects, and overall attitude. Inclusion criteria required use of a typical antipsychotic drug in the past and a switch to an atypical antipsychotic drug for at least two weeks. Chart review was performed to assess demographic data, medication profile, and diagnosis.
RESULTS: Among 24 patients surveyed, 83% were aware of differences in the efficacy and side effects between their antipsychotic drugs after switching, but only 67% reported a positive attitude toward their new medication. Approximately 71% of the patients experienced improvement in psychotic symptoms, and 62% experienced improvement in extrapyramidal side effects. Fisher exact test analysis showed no statistically significant correlation between patients being aware of differences in their medications and having a positive attitude towards the medication. However, there was statistically significant correlation between patients having positive attitude and improved psychotic symptoms and extrapyramidal side effects.
CONCLUSION: Patients who are aware of differences in the efficacy and side effects between typical and atypical antipsychotic drugs do not necessarily have a positive attitude towards their drug therapy. The correlation between positive attitude towards the medication and improvement of psychotic symptoms as well as decrease in side effects suggests patient counseling should focus on these two areas when patients are switched to these newer drugs.

Rheumatology

121. Celecoxib medication use evaluation in a health maintenance organization. *Kathleen B. Orrico, Pharm.D.*, Nancy H. Toy, intern pharmacist; Kaiser Permanente Medical Center, San Francisco, CA.

PURPOSE: The goals of this review were to 1) determine the abidance of celecoxib prescribing with facility usage guidelines; 2) assess the analgesic effectiveness of celecoxib through patient survey; 3) identify medication side effects and adverse effects.
METHODS: A review of the medical records of 137 members who received a prescription for celecoxib between April and July of 1999 was conducted at Kaiser Permanente South San Francisco Medical Center. Patient data were analyzed to determining compliance with approved institutional use guidelines. This descriptive evaluation included a telephone survey, and a semi-quantitative pain scale was used to assess analgesic effectiveness of the drug and to identify any untoward effects.
RESULTS: Of the 137 members identified, 121 were available for interview. Celecoxib use criteria were satisfied as follows: 1) a diagnosis of rheumatoid arthritis or osteoarthritis (69%); 2) the presence of risk factors for GI complications (78%); (age > 60 years, past history of GI bleeding or PUD, concomitant corticosteroids) 31% rated effectiveness as "relieved pain very well and provided continued relief"; 39% reported poor relief of pain. The discontinuation rate was 54%; 40% returned to previously prescribed analgesic medications. Drug side effects were experienced in 29%: dyspepsia, nausea, dizziness, fatigue, blurred vision, sweating, headache, back pain, tachycardia, sun sensitivity, rash.
CONCLUSION: Celecoxib was prescribed in accordance with institutional guidelines in 58% of 121 members reviewed. Celecoxib was only marginally effective in this patient population. The cost of the drug and its lack of efficacy suggest limiting its use to those at highest risk for GI complications.

Substance Abuse/Toxicology

122. Characteristics of cocaine and ethanol co-abuse. *S. Casey Laizure, Pharm.D.*, Lawrence Madlock, M.D.; University of Tennessee; Veteran Affairs Medical Center, Memphis, TN.

PURPOSE: The discovery of cocaethylene, an active cocaine metabolite produced only in the presence of alcohol, has lead to speculation that the co-abuse of cocaine and alcohol is an attempt by users to increase the duration of the cocaine high. The purpose of this study was to evaluate the users' perceptions of their cocaine and alcohol abuse.
METHODS: Subjects were recruited from patients admitted to the inpatient chemical detoxification unit at the Veterans Affairs Medical Center in Memphis, TN who co-abused cocaine and alcohol. Each subject was asked a series of predefined questions about how and why they used cocaine and alcohol. Four questions were asked about how often they used either substance alone (two questions) and in what order they used cocaine and alcohol when co-abused (two questions). The possible responses were: always, sometimes, most of the time, or never.
RESULTS: Forty-three subjects (42 male, 1 female; 40 African-American, 3 Caucasian; average age 44.3 ± 4.6 years) were interviewed. All but one subject had a history of drinking that preceded their cocaine use with an average age of the first drink at 14.6 years compared to an average age of 31.7 years for first time use of cocaine. Alcohol use was split evenly between beer/wine and distilled spirits, 53% vs 47%, respectively and smoking predominated as the preferred route of cocaine use (86%). Subjects did not always co-abuse cocaine and alcohol, with 40% stating that they used alcohol alone most of the time and 14% stating that they used cocaine alone most of the time. When subjects did co-abuse, alcohol was usually used first with 30% saying they always used alcohol first and 33% saying they used alcohol first most of the time versus only 7% who said they always used cocaine first and 5% who said they used cocaine first most of the time. When asked why they used cocaine and alcohol together, 63% stated it was to decrease the bad effects of cocaine, 7% said it was to increase the cocaine high, and 30% had other reasons. Only one subject specifically claimed that they co-abused with the intention of increasing the duration of the cocaine high.
CONCLUSIONS: Co-abusers of cocaine and alcohol tend to drink before using cocaine with the intention of decreasing the bad effects associated with the cocaine high ($p=0.023$). These results do not support the idea that co-abuse of cocaine and alcohol is an intentional method of increasing the duration of the cocaine high.

123. Smoking cessation and prevention in community pharmacies. *Rachel L. Couchenour, Pharm.D., BCPS*, Kit N. Simpson, D.Ph., Monina R. Lahoz, Ph.D., Deborah Stier Carson, Pharm.D., BCPS; University of South Carolina, Charleston, SC.

PURPOSE: To assess community pharmacists' 1) involvement in smoking cessation (SC) activities; 2) involvement in smoking prevention; and 3) barriers to providing a SC service in a community pharmacy.
METHODS: Mailed anonymous survey to 325 randomly selected community pharmacists in South Carolina.
RESULTS: Response rate was 34% (110/325). The typical respondent was male (58%), licensed for 21 years (range: 1 to 49 years), had a Bachelor of Science degree (93%), and practiced in a chain drug store (60%). Fifty-six percent of pharmacies sold tobacco products. Respondents estimated that 30% of their patients smoked. Of the pharmacists who had received continuing education (CE) on SC, only 26% worked in a pharmacy that offered SC services. The majority "almost never" or "infrequently" asked patients about smoking when dispensing medications. Four had given a smoking prevention talk during the previous six months. Barriers to providing SC services included 1) time constraints (90%); 2) lack of space (68%); and 3) reimbursement (77%). Twenty-five percent did not think it was the pharmacist's responsibility to provide SC services. Of those who felt it was the pharmacist's responsibility, 40% indicated that it was a frustrating task regardless of obtaining CE or not on SC.
CONCLUSION: In South Carolina few community pharmacists are involved with smoking cessation or smoking prevention activities, although they estimated 30% of their patients smoked. Barriers were identified and

programs need to be developed to assist the pharmacists that feel it is their professional responsibility to provide SC.

Transplantation/Immunology

124. Low-dose fluconazole fungal prophylaxis in primary renal transplant recipients: a retrospective analysis. *Lonnie Smith, Pharm.D.*, Troy Somerville, Pharm.D., Fuad Shihab, M.D.; University of Utah Hospitals and Clinics, Salt Lake City, UT.

PURPOSE: The primary objective of this study was to evaluate the efficacy of a low-dose fluconazole prophylaxis regimen in primary renal transplant recipients. A secondary objective was to evaluate the clinical significance of the pharmacokinetic interaction with cyclosporine at this low dosage.
METHODS: All primary renal transplant patients between January 1996 and January 1997 were evaluated utilizing all available clinical records. Parameters in the analysis included: immunosuppression regimens (including induction therapy), type of transplant, cyclosporine levels (during and after fluconazole), and any fungal infections.
RESULTS: All patients received oral fluconazole 50 mg daily for one month unless contraindicated. The study included 55 of 66 eligible patients (34 cadaveric and 21 living-related). All patients received maintenance immunosuppression with cyclosporine (Neoral®), azathioprine and prednisone. Cadaveric transplant recipients received OKT3 induction. The only noted fungal infections were oral thrush (five episodes) and vaginal yeast (two episodes), and none of these infections occurred while patients were on fluconazole. No serious fungal infection occurred and no fluconazole resistance was noted. Low dose fluconazole did not result in a statistically or clinically significant pharmacokinetic variation in cyclosporine levels. Only 47% (26/55) of patients required a cyclosporine dose change after stopping fluconazole. The majority of cyclosporine adjustments (88.5%) were dosage decreases. Only three patients (11.5%) required a dose increase (possibly explained by a pharmacokinetic interaction with fluconazole) after stopping prophylaxis.
CONCLUSION: Low dose fluconazole provides a simple and effective fungal prophylaxis in primary renal transplant recipients without significantly affecting cyclosporine levels.

125. Ethnic disparities in the pharmacology of tacrolimus in heart transplantation. *P.A. Uber*, M.R. Mehra, R.L. Scott, K. Srigiri, S. Pulakurthi, W. Zaffrani, A. Prasad, M.H. Park; Ochsner Medical Institutions, New Orleans, LA.

PURPOSE: Little information exists with regard to the influence of ethnicity on the pharmacokinetics of tacrolimus immunosuppression in heart transplantation, particularly in the presence of adjunctive mycophenolate mofetil use.
METHODS: We conducted a prospective investigation in 35 primary heart transplant recipients (17 African American, 18 Caucasian) using tacrolimus, mycophenolate mofetil and corticosteroid-based maintenance immunosuppression, from January 1998 to June 1999. We specifically sought to evaluate differences in the daily doses and blood levels achieved of tacrolimus between African Americans and Caucasians. Furthermore, our investigation sought to establish longitudinal trends in drug exposure over a 6-month period.
RESULTS:

	Daily Dose 3 months	Daily Dose 6 months	p value	Level 3 months	Level 6 months	p value
African Americans	8.4 ± 3.6	9.1 ± 4.5	NS	16.7 ± 2.3	11.9 ± 2.2	<0.01
Caucasians	5.4 ± 2.2	4.4 ± 2.2	0.05	16.9 ± 3.5	15.3 ± 2.8	0.02
p value	0.006	0.009		NS	0.002	

African Americans required a 55% daily increment in tacrolimus doses compared with Caucasians. Furthermore, despite declining target blood levels over time, no decreases in the daily dose requirements were evidenced for African Americans. No differences in the dose of mycophenolate mofetil were noted in the two study groups.
CONCLUSION: Distinct pharmacokinetic disparities in heart transplant recipients are demonstrated in African Americans compared to Caucasians exposed to tacrolimus. The evidence of ethnic pharmacokinetic incongruency in heart transplant recipients treated with tacrolimus indicate that prospectively initiated pharmacological strategies targeted to exploitation of the CYP 3A4 system in African Americans may be warranted.

126. A survey of medication adherence in kidney transplant patients. *Maria Tanzi, Pharm.D.*, Eva M. Vasquez, Pharm.D.; University of Illinois, Chicago, IL.

PURPOSE: The purpose of this study was to identify factors that may affect medication adherence in kidney transplant patients.
METHODS: A questionnaire was developed and mailed to 270 kidney transplant recipients at our center to assess medication adherence. The questions assessed demographic factors, time post-transplant, socioeconomic status, insurance coverage, knowledge of medications, adherence with medications and clinic visits, patients understanding of the impact of nonadherence with immunosuppressive medications on graft outcome, and overall tolerance of medications. Objective measures of medication adherence for the purposes of this study included an assessment of cyclosporine and tacrolimus blood trough levels. Student's t-test and χ^2 test were used for statistical analysis as appropriate. P values less than 0.05 were considered statistically significant.
RESULTS: A total of 95 questionnaires were returned. Fifty-five percent of patients were determined to be noncompliant and 45% of patients were determined to be compliant with their medications. The noncompliant and compliant group did not differ with respect to age, sex or race. Noncompliant patients were further out post-transplant when compared to compliant patients (83 ± 60.7 months vs 56 ± 48.9 months, respectively; $p<0.05$). Type of insurance or funding for medications did not appear to affect adherence in our patient population. Compliant patients exhibited greater knowledge of their immunosuppressive medications (88%) versus noncompliant patients (69%; $p=0.05$). Patients determined to be noncompliant with their medication regimens were also more noncompliant with their scheduled clinic visits; approximately 65% of these patients had missed one or more scheduled clinic visits. The majority of patients (90%) were aware of the ramifications of medication nonadherence on graft outcomes. Tolerance of immunosuppressive medications did not appear to be a factor influencing medication adherence in our patient population.
CONCLUSIONS: Medication nonadherence was very prevalent in our patient population and tended to occur further out post-transplant. Compliant patients exhibit greater knowledge of their immunosuppressive medications emphasizing the importance of continued patient education in this patient population.

127E. Erythromycin breath test as an indicator of tacrolimus safety and efficacy. *Iman E. Bajjoka, Pharm.D.*, Kirenza Q. Francis, R.Ph., Neeta Amin, Pharm.D., Viken Douzdjian, M.D., Marwan S. Abouljoud, M.D.; Henry Ford Hospital, Detroit, MI.

Presented at the 50th Annual Meeting of the American Association for the Study of Liver Diseases, Dallas, TX, November 6, 1999.

128. Intravenous versus oral ganciclovir in the prevention of cytomegalovirus in liver transplant recipients. *Iman E. Bajjoka, Pharm.D.*, Kirenza Q. Francis, R.Ph., Viken Douzdjian, M.D., Marwan S. Abouljoud, M.D.; Henry Ford Hospital, Detroit, MI.

PURPOSE: The occurrence of cytomegalovirus (CMV) infection after liver transplantation correlates with decreased patient/graft survival. In liver transplant recipients, intravenous ganciclovir (IV-G) followed by oral acyclovir (PO-A) has been shown to be effective in decreasing CMV incidence. This study compares oral ganciclovir (PO-G) to the standard IV-G.
METHODS: Liver transplant patients were randomized to receive 14 days of IV-G (5 mg/kg q12h), or PO-G (1g q8h), followed by 10 weeks of PO-A (800 mg QID). Doses were adjusted for renal function. Immunosuppression consisted of tacrolimus, mycophenolate mofetil and steroids. Acute rejection (AR) was treated with methylprednisolone and resistant AR was treated with OKT3 or ATG. Blood CMV PCR was performed weekly for 3 months and then monthly for 3 months. Tissue biopsies were performed as needed.
RESULTS: Thirty-four patients were evaluated; seventeen in each group. CMV disease occurred in four patients in the IV-G group vs three in the PO-G group ($p=1.0$). CMV infection was seen in five patients in the IV-G group vs four in the PO-G group ($p=0.6$). The mean time to onset of CMV disease was 75 days in the IV-G group vs 92 days in the PO-G group ($p=0.78$). Both groups had comparable rates of CMV (D/R) status, AR and antilymphocyte therapy. Adverse drug reactions were similar in both groups; drug charges were significantly higher in the IV-G group ($p<0.05$).
CONCLUSIONS: In this pilot study, PO-G is equally effective and safe as IV-G for the prevention of CMV disease in liver transplant patients. In addition, oral ganciclovir is more cost-effective than the intravenous formulation.

129. Substitution of intravenous acyclovir with oral once daily valacyclovir for viral prophylaxis in bone marrow transplant population: is there a cost saving? *Van D. Hoang, Pharm.D.*, Thomas P. Bechtel, Pharm.D.; Arthur G. James Cancer Hospital and Research Institute; Ohio State University Medical Center, Columbus, OH.

PURPOSE: This study examined the cost of antiviral therapy to determine if substituting oral once daily valacyclovir for three times daily intravenous acyclovir in the post bone marrow transplant (BMT) period would result in a significant cost saving. Most BMT programs routinely administer intravenous acyclovir in doses ranging from 500 to 1500 mg/m^2/day as prophylaxis for reactivation of herpes simplex virus (HSV) in the immediate post-transplant period. Our institution used intravenous acyclovir 750 mg/m^2/day. It was thought that substituting intravenous acyclovir with valacyclovir would reduce cost without compromising efficacy.
METHODS: Medical records of 125 patients admitted for BMT between July 1, 1998 and June 30, 1999 were reviewed. These patients received valacyclovir 500 mg daily instead of intravenous acyclovir from the day before

transplant until initial discharge. Ninety patients (72%) required temporary switch to intravenous acyclovir for several days due to inability to take oral medications.
RESULTS: Total cost of antiviral therapy utilizing valacyclovir and intravenous acyclovir was $19,297 compared to $42,877 if all patients had received intravenous acyclovir. This showed a drug cost saving of $23,580 (55%). The incidence of HSV reactivation in this time period was similar to that in the previous year when antiviral prophylaxis had included only intravenous acyclovir.
CONCLUSION: Substitution of intravenous acyclovir with oral once daily valacyclovir results in a significant cost saving without an increase in the incidence of HSV reactivation. This analysis does not include other costs such as drug preparation costs, pharmacy time, and nursing time. Inclusion of these costs would demonstrate an even greater saving.

130. New HBIg prophylaxis protocol in liver transplantation saves almost $2 million without compromising patient outcome. *Curtis D. Holt, Pharm.D.*, Gordon Ingle, Pharm.D., Gregg Kunder, R.N., Rhafik M. Ghobrial, M.D., Ph.D., Ronald W. Busuttil, M.D., Ph.D.; University of Los Angeles Medical Center, Los Angeles, CA.

Historically, the mainstay of prophylaxis against recurrent hepatitis B (HBV) after liver transplantation was passive immunotherapy with HBV immune globulin (HBIg). Intravenous HBIg is expensive and associated with significant toxicities. The approval of lamivudine has allowed new protocols to reduce doses of HBIg and administer it by the IV and intramuscular route.
PURPOSE: Evaluate the cost and outcomes of a new liver transplant HBV prophylaxis protocol at UCLA medical center.
METHODS: Previous protocol: HBIg 10,000 IU IV anhepatically followed by 10,000 IU IV daily for six days post-transplant. Ten thousand IU IV was given every other week until hospital discharge and once a month for life, as an outpatient. New protocol: HBIg 10,000 IU IV anhepatically, then 2,000 IU IV for six days and every other week until hospital discharge. As an outpatient, HBIg 1,000 IU IM was given every two to four weeks based on anti-HBs titers. Patients received daily oral lamivudine. Estimated cost savings during the first year post-transplant with the new protocol is $79,550/patient.
RESULTS: Since February 1999, 49 outpatients have been converted to the new protocol. Since August 1999, seven patients have received the new protocol from the time of transplantation. Subtracting the cost of lamivudine and realizing some patients required additional IM or IV doses of HBIg, the total cost savings thus far is $1,830,376. No patient has experienced recurrent HBV.
CONCLUSIONS: The new protocol resulted in significant cost savings without compromising patient outcome. Continued prospective monitoring is essential to assess protocol effectiveness.

131. Comparative dose study of filgrastim in peripheral blood progenitor cell transplant for non-myeloid malignancies. *Deb S. Sherman, Pharm.D.*, Roy Jones, M.D., Elizabeth Shpall, M.D., Richard Barron, R.Ph., M.S.; University Hospital, University of Colorado, Denver, CO.

PURPOSE: Filgrastim (G-CSF) is administered after peripheral blood progenitor cell (PBPC) transplant to decrease the duration of neutropenia. This study was designed to evaluate the comparative efficacy of filgrastim 5 µg/kg/day versus 10 µg/kg/day post-autologous PBPC transplant.
METHODS: This was a prospective, randomized, double-blind study. Patients admitted for autologous PBPC transplant were enrolled after providing informed consent. Exclusion criteria were myeloid malignancy or participation in another growth factor protocol. Filgrastim 5 µg/kg/day or 10 µg/kg/day was started on D-1 as a 30-minute intravenous infusion and continued until engraftment. Time to engraftment, the primary outcome measure, was defined as the time from absolute neutrophil count (ANC) < 500 cells/MICROl until ANC ≥ 500 cells/MICROl for three consecutive days or a single ANC > 2500 cells/MICROl. Secondary outcome measures included thrombocytopenic days (platelet count < 20,000 cell/ml), platelet transfusions, febrile days (temperature ≥ 38.3° C), days of parenteral antibiotics, and length of stay. Drug cost was estimated from filgrastim utilization patterns.
RESULTS: Sixty-two patients were evaluated, 32 in the 5 µg/kg/day group and 30 in the 10 µg/kg/day group. Demographic parameters were similar between groups. Mean times to engraftment were 9.7 ± 2.5 days versus 9.7 ± 2.2 days in the 5 µg/kg/day and 10 µg/kg/day groups, respectively (p=0.97). Number of thrombocytopenic days, platelet transfusions, febrile days, days of parenteral antibiotics, and length of stay were similar between the groups.
CONCLUSIONS: Similar outcomes were observed when filgrastim 5 µg/kg/day or 10 µg/kg/day was administered post-autologous PBPC transplant. The lower dose was associated with similar outcomes in this patient population and a potential drug cost savings of $250,000/year.

Women's Health

132E. Pharmacy database vs interviews with women: unexpected adherence with estrogen replacement therapy or hormone replacement therapy. *Martha Stassinos, Pharm.D.*, Ronald J. Ruggiero, Pharm.D.; University of California, San Francisco, CA.

Presented at the 10th Annual Meeting of the North American Menopause Society, New York, NY, September 23-25, 1999.

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.

133. Development, implementation and evaluation of guidelines for the use of glycoprotein IIb/IIIa receptor inhibitors. *Rebecca L. Chasman, Pharm.D.*; Methodist Healthcare, Memphis, TN.

PURPOSE: To describe the development and implementation of guidelines for the use of glycoprotein (GP) IIb/IIIa receptor inhibitors. The guidelines were to serve as a recommendation to the referring and admitting physicians on the appropriate patient, agent, dose and length of infusion.
METHODS: The development of the guidelines was a joint venture between pharmacy and cardiologists. Several steps were completed prior to submission to the Pharmacy and Therapeutics Committee (P&T). 1) A review of the literature was performed to evaluate the use of the agents in a setting similar to the institution. 2) The major clinical trials utilizing the GP IIb/IIIa inhibitors were summarized and prepared in a poster format and placed in the cardiac catheterization lab for several months to educate physicians. Incidence of bleeding, cost to the institution and drug specific contraindications were also presented. 3) Small group discussions involving emergency room physicians, cardiologists and clinical pharmacists were held on a routine basis to discuss the appropriate role of the agents in the institution. 4) The draft proposal was discussed and evaluated by the P&T cardiology subcommittee. 5) Guidelines were reviewed and approved by the P&T committee. 6) The guidelines were distributed to the nursing, cardiology, emergency department and pharmacy staff.
RESULTS: A prospective review of all patients receiving a GP IIb/IIIa inhibitor will be performed to determine compliance with the guidelines and describe the need for further education. Indication for the agent, choice of agent, length of infusion, concomitant heparin dosing, and presence of contraindications will be specifically evaluated.

134. Impact of a clinical pharmacist on medication costs: a coronary care unit experience. *Pritesh J. Gandhi, Pharm.D.*, Barbara Maas, Pharm.D., Gary R. Tataronis, M.S.; Massachusetts College of Pharmacy and Health Sciences; University of Massachusetts Memorial Health Care, Boston, MA.

PURPOSE: At our institution, coronary care unit (CCU) medication costs increased by 63.4% from October 1996-June 1997 to October 1997-June 1998. This study was conducted to 1) determine if medication costs/admission/month could be stabilized with the introduction of CCU pharmaceutical care services; and 2) evaluate the impact of pharmacotherapist initiated interventions in terms of medication cost avoidance (CA).
METHODS: Drug costs/admission/month from October 1997 to June 1998 (non-intervention period [NIP]) were compared to drug costs/admission/month from July 1998 to March 1999 (intervention period [IP]). Cost avoidance secondary to pharmacotherapist interventions was determined from January 1999 to April 1999 with Clinitrend™ for Windows™ 95. Patient demographics, acuity of illness and length of stay data were collected for both the NIP (n=898) and IP (n=960).
RESULTS: Patient age, case-mix index, ventilator days and length of stay did not differ between the two periods (p=NS). Total average drug costs/admission/month with traditional and clinical pharmacy services were $398.36 ± $82.82 and $381.94 ± $61.16, respectively (p=NS). Costs incurred for biotechnological drugs increased (p≤0.05) and costs of sedatives decreased (p≤0.05) from the NIP to the IP. A total of 1469 pharmacotherapeutic recommendations were documented from January 1999 to April 1999. Cost avoidance attributed to the 1469 interventions was $129,033 (annual potential CA of $387,099).
CONCLUSION: Drug costs in the CCU were stabilized and provision of clinical pharmacy services resulted in substantial CA. This evaluation justifies clinical pharmacy services in the CCU and expansion of these services to other high drug use areas in the institution.

135. The impact of clinical pharmacy management on cardiovascular risk reduction in patients with established heart disease in a group model health maintenance organization. *Angela M. Hitchcock, Pharm.D.*, Tammy R. Lousberg, Pharm.D., BCPS, John Merenich, M.D.; Colorado Region Kaiser Permanente, Lakewood, CO.

PURPOSE: Epidemiological data have shown that effective implementation of lipid lowering therapy is achieved in less than 25% of eligible patients with coronary artery disease (CAD). The purpose of this study was to compare low-density lipoprotein cholesterol (LDL) reduction in patients with CAD enrolled in a clinical pharmacy-managed cardiac risk reduction service

(CPCRS) to usual care (control).
METHODS: This study was designed as a prospective cohort trial. A computerized CAD registry was used to identify 100 consecutive CPCRS patients and 95 control patients with LDL > 130 mg/dl prior to study entry. Chart audit was used to document demographic data. Primary outcomes measured were percentage of patients to reach HEDIS LDL goal (< 130 mg/dl) and mean percent LDL reduction at 6-month follow up.
RESULTS: Baseline characteristics were similar between groups. Patients managed by CPCRS were more likely to receive follow up within six months (92% vs 50%, p=0.001). A significantly greater percentage of patients managed by CPCRS reached LDL goal < 130 mg/dl at six months (72% vs 27%, p=0.001). Mean LDL reduction in the CPCRS group versus usual care was 25% (39 mg/dl) and 13% (20 mg/dl), respectively (p<0.001).
CONCLUSION: CPCRS significantly impacted effective implementation of lipid lowering therapy in CAD patients. CPCRS patients were managed more aggressively, achieved greater LDL reduction, and were more likely to achieve LDL goal. Several clinical trials suggest these results will decrease CAD hospitalizations, coronary procedures and overall cost of CAD management. Based on these preliminary results, CPCRS is targeting other pharmacologic cardiac risk reduction strategies to further impact morbidity and mortality.

136. Decrease in high density lipoprotein levels among patients taking atorvastatin in an inner-city population. *Kyoung Sil Kim, Pharm.D.,* Ileana M. Rodicio, M.D., Roxana Stoica, M.D., Edwin Avbuere, M.D., Syed Iqbal, M.D., L. Schiller, R.Ph., Steven Blum, Ph.D., N.C. Bhalodkar, M.D.; Bronx-Lebanon Hospital Center, Albany, NY.

PURPOSE: It has been reported that atorvastatin at 10 mg dose increases high density levels (HDL) by 8%. Recent reports have shown that atorvastatin may reduce HDL which may have adverse effect on coronary artery disease. We examined the effects of atorvastatin on HDL in our inner-city patients.
METHODS: A retrospective chart review of 35 patients on atorvastatin therapy was conducted. Adherence to medication was assessed by reviewing pharmacy outpatient medication profiles. Lipid profiles before and after therapy were reviewed.
RESULTS: Out of 35 patients, 21 (60%) were adherent to treatment. There was no difference in the baseline characteristics between adherent and non-adherent with regards to age, sex, ethnicity and baseline lipid levels. Females comprise 50%, black and Hispanics 87%, average age 55 years, 76% hypertensives and 57% diabetics. Mean pretreatment total cholesterol, LDL, HDL and triglycerides were 285, 181, 50 and 260, respectively. And post-treatment levels were 198, 117, 47 and 163, respectively, at a median of 125 days follow up. HDL decreased in 14 (67%), did not change in three (14%) and increased in four (9%). Overall mean HDL was reduced by 3 mg/dl (6%). HDL decreased by 2.3 mg/dl and 3.8 mg/dl at 10 and 20 mg dose, respectively.
CONCLUSION: In our patients, atorvastatin unexpectedly reduced HDL by 4.6% at 10 mg and by 7.8% at 20 mg dose. It was effective in reducing total cholesterol, LDL and triglycerides by 31%, 35% and 37%, respectively. The clinical significance of these divergent changes in lipid profile needs to be determined in a larger population.

137. Clinical and economic outcomes related to a pharmacist-managed cardiovascular risk reduction program in a Native American population. *Randy W. Burden, Pharm.D., Ph.C.,* Ritesh N. Kumar, B.Pharm., Diane L. Phillips, R.D., L.D., Matthew E. Borrego, Ph.D., R.Ph.; Santa Fe Indian Hospital Native American Cardiovascular Risk Reduction Program, Santa Fe, NM; University of New Mexico, Albuquerque, NM.

PURPOSE: To determine: 1) the percentage of patients and average time taken to reach LDL-C goal with exercise, diet, or medication therapy or a combination of these therapies; 2) the cost-effectiveness of managing program patients with diet therapy alone versus medication plus diet therapy; 3) a decision analytic model comparing health care costs and outcomes for patients managed in the cardiovascular risk reduction program (CVRRP) versus those managed by physicians.
METHODS: A retrospective chart review of Santa Fe Indian Health Service CVRRP patient visits from March 1997 through October 1999.
PRELIMINARY RESULTS: Sixty-three of 150 patients treated for various dyslipidemias were included in the initial analysis. Of the 27 patients that were managed for elevated LDL-C levels, all were brought to goal. The average time taken to reach LDL-C goal was 3.7 months. Fifty-nine percent of the patients reached goal without pharmacotherapy. Of these patients, 9 of 27 were exercising and received diet counseling and 7 of the 27 were on exercise therapy only (i.e., no dietitian visits). The remaining 11 patients were brought to goal with diet, exercise, and drug therapy.
CONCLUSIONS: Although a research in progress, it will be interesting to observe whether the pharmacist managed CVRRP has led to cost avoidance and prevention of future cardiovascular events. This study provides an example of the contribution pharmacists can make in cardiovascular risk reduction management in a unique population. Study results may allow the CVRRP to serve as a model for other organizations wanting to establish such programs.

138. Institutional guidelines to improve the management of patients with a suspected pulmonary embolism. *Valérie Le Jeune, Pharm.D.,* Emmanuelle Lemoigne, M.D., Sophie Jobard, Pharm.D., Gilles Piriou, Pharm.D., Marie Bénédicte Coutte, M.D., Christophe Leroyer, P.H.D., Dominique Mottier, P.H.D., Nicole Borgnis-Desbordes, Pharm.D.; The VTE Group; University Hospital, Brest, France.

Venous thromboembolism (VTE) is a frequent (700,000 cases/year) and serious disease (20,000 deaths/year) in France. In the first part of the quality assurance program carried out at the university hospital of Brest, important local malfunctions in the diagnostic and therapeutic approach of VTE were highlighted. From January to July 1997, 417 patients with a suspected VTE were included in eight units of our hospital. The diagnostic waiting period was more than 48 hours in 145 out of 417 patients (34.6%). When VTE was suspected, 153 patients (36.4%) anticoagulant treatment was not administrated while 14 inconclusive echo Doppler (of 342 performed) and 40 nonexclusive pulmonary scintigraphies (of 252 performed) were not subjected to any other explorations. This study showed important local malfunctions in the diagnostic and therapeutic management of VTE in our hospital.
STRATEGY FOR IMPROVEMENT: With the methodologic help of the Quality Care Evaluation and Accreditation Commission, a work group including medical practitioners, pharmacists, nurses, laboratories, radiology, nuclear medicine has been set up to define corrective measures to improve the management of pulmonary embolism (PE) in our hospital. Guidelines and a decision-making channel based on the established consensus and on the local hospital organization were written. This document, after authentication by several hospital boards (Medical Commission, Pharmacy and Therapeutic Committee, Quality Care Evaluation and Accreditation Commission), will become a reference procedure for the management of PE in our hospital. A leaflet with a decision-making channel has been printed and will be sent to all pregraduated medical students in the university hospital. The impact of these measures will be checked by achieving a set of other assessments with the same criteria and method. This work will be pursued with several other different pathologies such as cerebral or digestive hemorrhages.

139. Clinical pharmacy involvement in congestive heart failure/cardiac transplant evaluation in a university-based cardiology clinic. *Amy L. Seybert, Pharm.D.,* Michael A. Shullo, Pharm.D.; University of Pittsburgh Medical Center, Pittsburgh, PA.

PURPOSE: This evaluation describes the involvement of a pharmacist in the cardiac transplantation evaluation process at a large, university-based health system. This pilot integrative model includes physicians, nurses, nutritionists, social workers, and pharmacists. The pharmacist has the following responsibilities: providing patient medication education, evaluation of patients' accountability for maintaining compliance with therapy, optimization of pharmacotherapeutic and dietary management, and needed assistance with prescription/financial issues.
METHODS: Every patient that is referred to the university-based health system for cardiac transplant evaluation is scheduled to meet with a pharmacist. Each formal patient consultation includes a baseline disease education session, complete medication history, pharmacotherapeutic education, overview of daily medication schedule, and compliance education. Patient education material and compliance assistance information is provided for patients. A clinical pharmacist educates all cardiac transplantation candidates monthly on medications that they may receive after transplantation.
RESULTS: Twenty-one patients have been evaluated over the past six months. Preliminary results show that all 21 patients required pharmacists' intervention in the form of education, medication and dietary compliance, or financial assistance for medication reimbursement. Specifically, the following interventions were performed: 21 medication/disease state education, 18 compliance assistance/education, 14 drug optimization, ten dietary optimization/education, and two prescription assistance.
CONCLUSIONS: An integrated approach that includes pharmacists' involvement in the cardiac transplantation assessment has helped to optimize patient care. Based on this pilot integrative model, further documentation of pharmacists' involvement in the cardiac transplantation process will be performed. Also, further implementation and development of education/compliance assessment tools will continue.

140. Involvement of pharmacists in drug therapy decision making in a pediatric critical care unit. Angela Trope M.Sc., Winnie Seto, Pharm.D., *Lynne Carfrae, B.Sc.Phm.*; Hospital for Sick Children, Toronto, ON, Canada.

PURPOSE: To determine the degree of involvement of pediatric critical care unit (CCU) pharmacists in decisions made by physicians regarding drug therapy and to compare the level of practice of the pharmacists.
METHODS: CCU pharmacists documented their patient care activities for eight weeks. For each drug therapy decision making event that they were involved in, pharmacists self-assigned a level of performance to their involvement (from 1 = order review to 4 = prescriptive/proactive), based on a modified Campagna decision-making model (Am J Health-Syst Pharm

1995;52:640-5). Data analysis included: patient acuity, the types of events, the proportion of events per patient and the proportion of events per performance level.
RESULTS: Three pharmacists followed 155 patients and influenced decision making in 108 (70%), with an average involvement of 4.4 events per patient. Types of decisions influenced most often were drug dosing (25.5%) and pharmacokinetics/therapeutic drug monitoring (26.4%). Pharmacist involvement was rated at a level four in over 60% of events. Pharmacists were similar in the proportion of events rated at levels one and four, but differed in events rated at level two or three. Differences were attributed to factors such as patient acuity, self-rating of performance levels and physician expertise.
CONCLUSIONS: All pharmacists had a high degree of involvement in drug therapy decision-making in the pediatric CCU. The high level of current practice supports new initiatives to expand the role of the pharmacist (example: medical directives). This type of data collection appears to be a useful tool to measure the performance of clinical pharmacists.

141. Economic impact of a pharmacist-initiated renal dosing policy. *Nikki L. Milan, Pharm.D.*, Monica M. Shieh, Pharm.D., Clifford W. Crabtree, R.Ph., M.B.A.; Harper Hospital; Wayne State University, Detroit, MI.

A 6-week evaluation of physician prescribing in patients with renal dysfunction revealed that 33% of renally eliminated medications exceeded manufacturer's dosing guidelines. In patients with kidney impairment, renally eliminated drugs may accumulate and lead to toxic adverse events. In addition to providing quality pharmaceutical care, dosage adjustment based on renal function has the opportunity for decreasing drug expenditures.
PURPOSE: The objective was to develop and implement a pharmacist-initiated renal dosing policy to automatically adjust medications in patients with renal dysfunction. The financial impact of the pharmacists' interventions was then evaluated.
METHODS: Utilizing published data, dosing guidelines were developed and stratified for adjustment based on defined creatinine clearance intervals. A policy regarding pharmacist-initiated renal dosing was developed with a multidisciplinary approach. Pharmacists were educated on evaluating renal function and pocket cards reflecting the approved dosing guidelines were distributed. Interventions were documented for two weeks to complete an economic evaluation and an annual cost savings was extrapolated.
RESULTS: Pharmacists' interventions were documented in 39 patients for a 2-week period. Adjustments were made in concordance with the policy 100% of the time. Cost of therapy without dose adjustment was compared with cost of therapy after dose modification for each patient. Pharmacist-initiated renal dosing for the 2-week period resulted in an actual drug acquisition savings of $3801 (an annual savings of approximately $99,000).
CONCLUSION: Renal adjustment not only decreases the potential for adverse medication events, it also produces a substantial reduction in medication expenditures.

142. Cost avoidance of providing intensive management of oral anticoagulation therapy. *Kenneth M. Shermock, Pharm.D.*, Fran Yanak, B.S.N., Kim Begany, Pharm.D., Lee Bragg, Pharm.D., Janet Ungar, R.Ph., Mort Goldman, Pharm.D., FCCP, BCPS, David A. Kvancz, M.S., R.Ph., FASHP; The Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: To quantify the cost avoidance of reductions in hospitalizations due to thromboembolic and hemorrhagic adverse events (AEs) by a pharmacy-based anticoagulation clinic (AC) compared to usual medical care (UMC) and to calculate a benefit/cost ratio for the AC service.
METHODS: A retrospective review of all patient charts was conducted to collect hospitalization rates for patients enrolled at the AC in 1998. A historical control group was constructed from literature to provide an expected hospitalization rate due to AEs in the UMC setting. The Healthcare Cost and Utilization Project (HCUP) database was utilized to assign national average costs for hospitalizations due to hemorrhagic and thromboembolic AEs.
RESULTS: A total of 1377 patients accounted for 562.5 patient years at the AC during 1998. The rate of hospitalization per patient year in the AC was less than would be expected in UMC for both hemorrhagic (0.0142 vs 0.0955) and thromboembolic (0.048 vs 0.106) events. Total cost avoidance due to hospitalizations avoided was $302,796. The cost of providing the service was $200,200. The benefit/cost ratio was 1.5:1.
CONCLUSION: Patients under the care of the AC have lower hospitalization rates due to hemorrhagic and thromboembolic AEs than would be expected in UMC. The reductions in hospitalization rates are sufficient to produce a net economic benefit from the institutional perspective.

143. Development of a pharmacoeconomic model to assess the value of pharmacist interventions. *Kenneth M. Shermock, Pharm.D.*, Todd W. Nesbit, Pharm.D., BCPS, Mort Goldman, Pharm.D., FCCP, BCPS, David A. Kvancz, M.S., R.Ph., FASHP; The Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: To develop a pharmacoeconomic model to assess the value of pharmacist interventions and to apply the model in the evaluation of a new clinical program.
METHODS: A model consistent with our computerized documentation system was constructed which classified pharmacist interventions using four categories: 1) drug information; 2) increased efficacy; 3) cost savings; or 4) cost avoidance. Each intervention was evaluated using the model to assess economic value. Cost savings were calculated by taking the difference in actual acquisition cost between the previous and the recommended therapy. Cost avoidance was determined by a clinical panel that estimated the probability that an adverse event would have occurred in absence of an intervention. This probability was multiplied by the cost of an avoidable adverse event, as published from a prospective study. Cost savings and avoidance were summed and compared with the cost of the program to calculate a benefit/cost ratio. Sensitivity analyses were performed.
RESULTS: Use of this model allowed for the calculation of direct cost savings ($39,436), cost avoidance ($219,258) and overall program benefit (benefit/cost ratio 3.2:1). Evidence of criterion validity was established by comparing a published value for annual cost avoidance of an ICU pharmacist ($271,730) with the annualized cost avoidance for our critical care pharmacist ($270,980). The model was fairly insensitive to variation in baseline parameters.
CONCLUSIONS: The pharmacoeconomic model provided the necessary framework to assess the value of pharmacists' interventions and to derive the benefit/cost ratio of a new clinical intervention program. Our method of assessing the value of interventions appears to provide a reasonable estimate.

144. Improvement of patient satisfaction and recognition after oral anticoagulation medication teaching service in Taiwan. *Hsiang-Yin Chen, M.S., Pharm.D.*, Chang Yang, B.S., Cheng-Fang Lee, B.S., Shing-Mei Hsu-Lee, B.S., You-Mei Lin, B.S., Li-Hua Huang, M.S.; Taipei Medical College, Taipei, Taiwan; St. John's University, New York, NY; Taipei Municipal Wang Fang Hospital, Taipei, Taiwan.

PURPOSE: The clinical impact of pharmacist-managed oral anticoagulation clinic has been well documented in the U.S. but much less in Asian countries. Due to the high frequency of traditional Chinese herbal self-usage in Taiwan, these patients require more intensive education when they are undergoing oral anticoagulation therapy. The present study implanted a warfarin patient education program at the infancy phase of pharmaceutical care in Taiwan.
METHODS: Patients who filled prescriptions with warfarin from the outpatient pharmacy at the Taipei Municipal Wang-Fang Hospital (TMWFH) were enrolled with written inform consent. Two sections of an oral anticoagulation education program were completed individually and a 33-page education brochure was given. A 100-point questionnaire was used to evaluate the medication knowledge before and after accomplishment of the program.
RESULTS Sixty patients consent into the oral anticoagulation patient education program from June 1999 to October 1999 in TMWFH. Average knowledge score after education was significantly increased from 5.2 ± 5.8 to 38.6 ± 12.9. The surveillance after the program showed that more than 80% of patients preferred to be taught in detail individually, 59 patients (98.3%) admitted the need for medication education, and 58 patients (96.7%) expressed their willingness to enroll in similar patient education programs later on. On a 5-level satisfaction scale, 35 patients (58.3%) were extremely satisfied to the program; 21 (35%) were satisfied quite a bit; four (6.7%) were somewhat satisfied; and none expressed that they were slightly or not-at-all satisfied.
CONCLUSION The present study demonstrated that convenient and personal patient education programs are a successful method to perform oral anticoagulation pharmaceutical care in Taiwan.

145. An evaluation of patient-directed asthma education programs: content, availability and usability. *Paul J. Munzenberger, Pharm.D.*, Ricardo Z. Vinuya, M.D., Jennifer A. Pickett, MSPH; Wayne State University, Detroit, MI; Detroit Asthma Coalition, American Lung Association of Michigan, Detroit, MI.

PURPOSE: The purpose of this evaluation was to determine the content, availability, and usability of selected asthma educational programs.
METHODS: Twenty education programs were reviewed. Content evaluation was based on the NHLBI recommendation of asthma pathophysiology, triggers, warning signs, peak flow meters, medication use, spacer use, patient action plan, and participant learning evaluation. Availability included program restrictions and provider or participant costs. Usability included available languages, target audience, reading grade level, program setting and time requirements.
RESULTS: Peak flow meters and medication use were not addressed by one program each. Four and 12 programs did not address spacers and participant learning evaluations, respectively. Use restrictions exist on eight programs. Fourteen programs reported some provider costs ranging from $1.50 for individual patient leaflets to $320 for instructor training and materials. Two programs reported patient costs of $10 and $30. In addition to English, five programs were available in Spanish. Programs were not available in other languages. Seven, seven and six programs targeted children, adults and both populations, respectively. Four programs had a reading grade level less than six. The rest were between six and eight. Two programs are intended for use in schools while the rest could be used in any setting. Four, six, and ten are

intended for use with individuals, groups, or either, respectively. Twelve programs may be completed during one while eight required two or more educational sessions.
CONCLUSION: In general, NHLBI content recommendations are followed. Limitations exist regarding available languages, program costs, and time required.

146. Documentation of student activities in a non-traditional clerkship model. *Andrew M. Peterson, B.S., Pharm.D., BCPS*; Felicia Dello Buono, B.S., Pharm.D., CDE, Tracy Offerdahl, B.S., Pharm.D., Jill Friedman, B.S.; Philadelphia College of Pharmacy; University of the Sciences, Philadelphia, PA.

PURPOSE: To determine patient care and provider activities performed by students in a nontraditional clerkship model and determine the likelihood of providers accepting students recommendations based on source of initiation.
METHODS: Patient and provider encounters were documented between 9/97 and 10/99 during ambulatory care rotations with physicians, physician assistants or nurse practitioners. Descriptive statistics were calculated on the type of service, activity performed, intervention type, reimbursement and accepted recommendations. Differentiation by initiating source will be analyzed by χ^2 methods.
RESULTS: We reviewed 1199 encounters. Services consisted of health education (63.3%) and drug monitoring (34.4%). The activities performed included patient assessment/planning (25.8%), medication review (20.9%), and identification of drug of choice (17.9%). Seventy-two percent of encounters took five to ten minutes. Five hundred and ten interventions were classified into predefined categories, or "other" (identified by the student). Commonly identified interventions included determining a need for pharmacotherapy (22.0%) and identifying patients requiring counseling (11.8%). Student initiated interventions accounted for 45.7% of total interventions, with an 80% acceptance rate (including partially accepted). Interventions initiated by someone other than the student had a higher likelihood of acceptance ($p<0.05$). Of the 1199, 92% (1103) were coded, yielding a potential $58,000 reimbursement. The average expected reimbursement is $48.41 per intervention (including those not coded).
CONCLUSIONS: The results of this study suggest that students actively assess patients, review medications and assist in the identification of therapy and drug monitoring needs. The activities initiated by providers or patients are more likely to be accepted than those initiate by students. These interventions are potentially reimbursable.

147. Impact of a pharmacist-run diabetes complications screening on diabetes care in a primary care clinic. *Christina Telford, Pharm.D.*, Karen A. Tisdel, Pharm.D., Evan M. Sisson, Pharm.D., Franklin J. Zieve, M.D., Ph.D.; McGuire Veterans Affairs Medical Center, Richmond, VA.

Clinical guidelines for diabetes care are well established, but their effects on clinical practice have been discouraging. Their implementation has been difficult, both in the Veterans Health Administration and in the private sector. These guidelines are time consuming for the primary care provider (PCP), which contributes to the inability of many PCPs to meet the guidelines during a routine visit.
PURPOSE: Establish a specialized clinic during which much of the patient data required to meet the Diabetes Quality Improvement Project (DQIP) performance measures is obtained for the PCP. Without the time burden of screening activities, the PCP should be able to focus on implementing the ADA clinical guidelines.
METHODS: Patients with diabetes from one of the three primary care clinics (n=1180) at the Richmond VAMC will make an annual visit to the complications screening clinic (CSC) two to four weeks in advance of a PCP visit. The annual visit to the CSC includes digital retinal photographs, visual acuity, foot examination, blood pressure, body mass index, tobacco status, lipid profile, hemoglobin A_{1c}, serum creatinine, urine microalbumin, educational and nutritional assessment, and depression screening. The results are compiled concisely for and available to the PCP within one week of CSC visit.
RESULTS: Since February 1999, 550 patients have completed screening. The patients with diabetes in the two remaining primary care clinics (n=1848) will serve as controls. Data analysis will include adherence to DQIP performance measures and ADA clinical guidelines.
CONCLUSION: A pharmacist-run diabetes CSC can minimize the impediment between knowledge and clinical practice.

148. Impact of a pharmacist intervention on the management of diabetes mellitus in a managed care organization. *Kristal L. Williams, Pharm.D.*, Aimee Gelhot Adams, Pharm.D., Bryan F. Yeager, Pharm.D.; University of Kentucky, Lexington, KY.

PURPOSE: To determine 1) baseline adherence of primary care providers at Kentucky Clinic to NCQA (National Committee for Quality Assurance) HEDIS measures and the standards of medical care for type 2 diabetes mellitus patients; and 2) evaluate the impact of pharmacist intervention on improving adherence to these guidelines.
METHODS: Medical charts of type 2 diabetics followed by internal medicine and family practice clinics with KHS or UKHMO insurance were analyzed retrospectively over one year for baseline adherence to diabetes standards of care. Criteria measured include: blood pressure, lipid profile, hemoglobin A_{1c}, eye/foot exams, microalbumin screening, and appropriate use of ACE inhibitors. Nonadherence areas will be targeted for pharmacy educational/clinical intervention. The impact of pharmacist intervention on adherence to guidelines by American Diabetes Association and NCQA HEDIS measures will be assessed.
RESULTS: Baseline adherence to diabetes standards of care pre-pharmacy intervention were: 1) 98% had blood pressure readings at each visit; 2) 53% of blood pressures were ≤ 130/85; 3) 45% had lipid profiles performed every three to six months; 4) 63% were within LDL goal; 5) 35% had $HgBA_{1c}$ levels < 7%; 6) 45% were screened for microalbuminuria; 7) 38% were treated with ACE inhibitors if microalbuminuria present; and 8) 38% and 28% were referred for eye and exams, respectively.
CONCLUSION: Currently, goals set by the 2000 NCQA HEDIS measures and standards of care for type 2 diabetic patients is not being met by primary care providers at Kentucky Clinic. Educational and clinical intervention by a pharmacist should significantly improve adherence and ensure NCQA accreditation.

149. Establishing a pharmacist-managed warfarin dosing program in a long-term care facility. *Susan K. Bowles, Pharm.D., FCCP*, Lisa Ruston, B.S.P., Sherry Cudmore, B.Sc.Phm.; Sunnybrook and Women's College Health Sciences Center, Toronto, ON, Canada.

PURPOSE: To describe the establishment of a pharmacist-managed warfarin dosing program in a long-term care facility.
METHODS: The service was implemented after both medical and nursing staff expressed concern regarding the management of patients receiving anticoagulation within the facility. Program development included an analysis of existing practice, reviewing the relevant literature, discussions with personnel from established programs and the development of a prescribing protocol. All five pharmacists working within the facility underwent a formal training program and service is provided 24 hours per day, 7 days per week. The protocol involves patient assessment, ordering INR measurements and warfarin dosing adjustments.
RESULTS: Preliminary quality assurance data, collected over the first six months of the program, indicates that pharmacists have decreased the proportion of subtherapeutic INR values (39% pre- and 22% post-implementation) and increased the proportion of therapeutic INR values (53% pre- and 67% post-implementation). An increase in the proportion of supratherapeutic INR values (8% pre- and 11% post-implementation) probably represents a diagnostic bias as pharmacists have proactively identified clinically important drug-drug and drug-disease interactions. The medical staff has renewed their support of the program following presentation of the quality assurance data.
CONCLUSIONS: A pharmacist-managed warfarin dosing program has been successfully implemented in a long-term care facility. Important to the success of the program has been having an on-site pharmacy service, formal training of the pharmacists and support from the nursing and medical staff.

150. Therapeutic outcomes and health care cost savings attributable to the collaborative practice of pharmaceutical care in an integrated health care system. *Brian J. Isetts, Ph.D., BCPS*; University of Minnesota, Minneapolis, MN.

PURPOSE: This is a description of the actual therapeutic outcomes, as well as, direct and immediate cost savings attributable to the collaborative practice of pharmaceutical care provided to patients in an integrated health care system.
METHODS: Accredited pharmaceutical care practitioners have been providing (comprehensive) pharmaceutical care to patients in high resource utilization groups since November 1998. Patients selected to receive care have primarily been in capitated health care plans, and documentation is achieved through use of a software program that tracks each patient's actual outcomes and drug therapy problem resolution status. All drug therapy problem/cost savings resolution claims are adjudicated by a panel of two practitioners.
RESULTS: Patients receiving pharmaceutical care in this collaborative practice are experiencing 1.96 drug therapy problems per patient and are taking, on average, 8.74 active medications/remedies for 5.22 medical conditions per patient. A combined total of 62.3% of all drug therapy treatment goals are being achieved at patients' initial pharmaceutical care encounters, compared to 88.4% of all treatment goals achieved at patients' latest follow-up pharmaceutical care encounters. In a sampling of 728 encounters there were $103,985.50 in direct and immediate health care cost savings, and 116 potentially serious and/or life-threatening adverse medication-related events avoided (16 hospitalizations, 39 emergency department visits, 10 long-term care visits, and 51 urgent care visits avoided).
CONCLUSIONS: Preliminary findings from a collaborative practice of pharmaceutical care are suggesting that drug-induced morbidity and mortality, as well as, overall health care expenditures can be reduced from this practice. Nevertheless, challenges related to efficiencies in the patient identification and recruitment processes remain.

151. Results from a clinical staff pharmacist practice model pilot program. *Todd W. Nesbit, Pharm.D., BCPS*, Kenneth M. Shermock, Pharm.D., Morton P. Goldman, Pharm.D., FCCP, BCPS, David A. Kvancz, M.S., FASHP; The Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: To assess the impact of a clinical staff pharmacist practice model in a large academic medical center.
METHODS: A new pharmacist practice model was implemented as a pilot program at the Cleveland Clinic Foundation in February 1999 to provide expanded pharmaceutical care services to hospitalized patients. Practitioners in this model worked closely with mentoring clinical pharmacist specialists within three established clinical pharmacy service areas (general medicine, critical care and hematology/oncology). Three full-time-equivalent pharmacists provided services to approximately 200 patients per day. Pharmacist activities and patient care interventions were documented and summarized using commercial software (Clinitrends™) customized to meet institutional needs. Direct cost savings, cost avoidance and overall program benefit/cost ratios were calculated. Pharmacist and physician satisfaction data were also assessed pre/post implementation.
RESULTS: In the first five months of the new practice model, the pharmacists documented 2482 patient care activities and interventions, with an overall physician acceptance rate of 90%. The most frequently documented interventions included therapeutic consultations, pharmacokinetic consultations, renal drug monitoring, drug information and alternate route recommendations, respectively. Calculated cost savings and avoidance for the study period were $258,694 (annual projected $620,863) with a net economic benefit of $178,450 (annual projected $428,280; benefit:cost ratio 3.2:1). Both pharmacist and physician satisfaction data indicated a high level of satisfaction with the practice model.
CONCLUSIONS: The clinical staff pharmacist practice model implemented with clinical decision support by clinical pharmacist specialists expanded pharmaceutical care services, yielded economic benefit to the institution, and enhanced pharmacist and physician satisfaction. Program expansion has been proposed based on the positive results demonstrated.

152. Nurses' opinions on pharmaceutical care plans in nursing homes in England. *Chanthonrat Sitthiworanan, B.Pharm.*, David J. Wright, Ph.D., B.Pharm., Jonathan Silcock, M.Sc., B.Pharm., Henry Chrystyn, Ph.D., M.Pharm., B.Pharm.; University of Bradford, West Yorkshire, United Kingdom.

PURPOSE: To design pharmaceutical care plans (PCPs) for use in nursing homes.
METHOD: A piloted questionnaire was posted to a random sample of registered nursing homes in England. This comprised four main sections: drug information, format of drug information, the value of PCPs and personal details. Follow up of nonrespondents was carried out four and eight weeks after initial mailing.
RESULT: Four hundred thirty-six (72.7%) of 600 questionnaires were returned; 86.8% of respondents were female. Main drug information source used in homes at present were patient information leaflets (PILs). Respondents strongly agree that medical history (70.7%), maximum dosage (65.1%), common side effects (62.2%), drug interaction (59.8%), start date (57.6%), therapy duration (53.2%) and intended therapeutic effect (51.6%) would improve their residents' care. 56.7% strongly agreed that information about residents' medication should be provided by supplying pharmacist. 82.6% of respondents stated a preference for one of the care plan formats provided. 94.4% agreed that PCPs would improve their knowledge of residents' medication and 66.0% that PCPs should be a requirement in nursing homes.
CONCLUSIONS: The minimum amount of information that should be included in PCPs is: medical history, maximum dosage, common side effects, drug interaction, start date, therapy duration and intended therapeutic effect. The information that nurses believe would most benefit their residents' care is not provided on PILs. Nurses are generally in agreement that the supplying pharmacist is the most suitable person to provide PCPs. Further research assessing the value of PCPs on residents' health is warranted.

153. Impact of criterion-based guidelines on utilization of intravenous immune globulin during a critical shortage. *Chin Y. Liu, Pharm.D.*, Virginia T. Spadoni, Pharm.D., Angela J. Milad, R.Ph., Margo S. Farber, Pharm.D., Clifford W. Crabtree, MBA, R.Ph.; Harper Hospital, Detroit Medical Center, Detroit, MI.

PURPOSE: A national critical shortage of intravenous immune globulin (IVIG) created a potential for total depletion of supply. It was essential that the limited supply of IVIG be preserved for those patients in whom its use is most critical. The objective of the program was to prevent total depletion of IVIG.
METHODS: Criteria for appropriate IVIG use were developed, approved by appropriate hospital committees and implemented by the pharmacy department. All medical and pharmacy staff were educated on the process for obtaining IVIG, which included review of all IVIG orders and rounding of doses by pharmacists, and provision of a medical specialist to grant final approval for use when outside of established guidelines.
RESULTS: IVIG supply was successfully maintained, with use meeting established criteria in 89.2% of patients receiving it during the first six months of 1999. Expenditures for IVIG were 51% ($191,700) less than during the same period in 1998 (185,000 vs $376,700, respectively). Dosing based on adjusted body weight and rounding of doses saved a total of 208 grams of IVIG, accounting for over $7000 of the savings. This program is projected to reduce IVIG expenditures by $383,400 annually.
CONCLUSION: Criterion-based guidelines for medication use and dose rounding by pharmacists, when appropriate, are effective means of ensuring optimal utilization of a medication during a critical shortage. These utilization strategies can be applied, even when stock levels are adequate, as a means of reducing inappropriate expenditures for high cost medications.

154. Development and evaluation of a program for the outpatient treatment of deep vein thrombosis with low molecular weight heparin. *Bob L. Lobo, Pharm.D., BCPS*, Angela K. Johnston, Pharm.D., William L. Greene, Pharm.D., BCPS, FASHP; Methodist Healthcare, Memphis, TN.

We developed a program to identify and discharge hospitalized patients with deep vein thrombosis (DVT) who qualified for outpatient treatment with low molecular weight heparin (LMWH). Since our utilization management (UM) team reviews the chart of every hospitalized patient during the hours of 0800 to 1630 Monday through Friday, they are able to identify potential candidates. When a member of the UM team identifies a patient admitted with a diagnosis of DVT or pulmonary embolism, they consult the clinical pharmacist on call. The clinical pharmacist performs a clinical assessment of the patient to rule out potential contraindications to LMWH and to identify barriers to the outpatient use of LMWH. If the patient is eligible, the physician is informed of the eligibility for outpatient treatment. If the physician agrees to discharge the patient, the home health (HH) team is consulted to obtain prior authorization for HH visits and for LMWH. If the patient does not have insurance, LMWH is paid for by the manufacturer's indigent care program, or the hospital donates the drug. HH nurses educate the patient on proper injection technique, and the clinical pharmacist educates the patient on warfarin therapy. The patient is provided with a prescription for a 7-day supply of LMWH to be filled at a preselected pharmacy. The HH nurse visits the patient during the first week to perform INRs and to assess injection technique. The clinical pharmacist calls the patient at one month and three months for follow up. Cost impact and outcomes to be discussed.

155. Development of a pharmacist-driven subcutaneous adjusted-dose heparin protocol for prophylaxis of venous thromboembolism in high-risk surgical patients. *Geoffrey C. Wall, Pharm.D.*, Stacy Higbee, R.Ph., Pharm.D. student, Adam Bengoechea, R.Ph., MHA, James Emery, R.Ph.; Drake University, Des Moines, IA; Pioneer Valley Hospital, West Valley City, UT.

PURPOSE: The American College of Chest Physicians suggests that subcutaneous adjusted-dose heparin (ADH) may be an alternative to low-molecular weight heparin (LMWH) and other modalities in preventing venous thromboembolism (VTE) in high-risk patients. A pharmacist-driven ADH protocol was developed in cooperation with the departments of pharmacy and surgery at a community hospital in suburban Salt Lake City, Utah. This protocol was developed to offer clinicians a cost-effective alternative to LMWH for VTE prophylaxis in high-risk patients.
METHODS: Following a literature review, the pharmacy department developed the protocol, policy and procedures for this service. Upon physician request, a staff pharmacist initiates the protocol by ordering heparin 5000 units subcutaneously every eight hours. An activated partial thromboplastin time (aPTT) is ordered six hours later and then every other day. The patient's ADH dose is adjusted based on a validated sliding scale that targets an aPTT in the high normal range. The patient is monitored daily for adverse effects, including thrombocytopenia.
RESULTS: To date, over 100 patients have been enrolled in the ADH protocol. One thousand two hundred twenty-three doses of heparin have been given on the protocol. No major bleeding episodes or VTE have occurred in patients on the protocol. One case of thrombocytopenia (94,000 mm^3) has been documented. Analysis has revealed that the ADH protocol has fewer costs compared to LMWH ($17.85 vs $96.00), even when the costs for aPTTs are included.
CONCLUSION: A pharmacist-driven ADH protocol can successfully prevent VTE in high-risk patients, with minimal adverse effects and fewer costs compared with LMWH.

156. Impact of pharmacy reimbursement team on patient care in an inner-city HIV clinic. *Susan K. Chuck, Pharm.D.*, Edward A. Aguirre, B.S., Apryle L. Smith, B.S., Stanley Patterson, Clifton A. Williams, B.S., Kiran Patel, B.S., Douglas E. Miller, Pharm.D.; Grady Health System, Atlanta, GA.

PURPOSE: Significant numbers of indigent patients have difficulty accessing antiretrovirals (ARVs) due to Georgia's limited AIDS Drug Assistance Program (ADAP) covering 410 patients with a 9- to 12-month waiting list of 502 patients. A pharmacy reimbursement team (PRT) was established to ensure access to ARVs regardless of insurance, Medicaid, or ADAP status.

METHODS: In 1997, a 2-person PRT began accessing ARV patient assistance programs (PAPs); completing Medicaid prior approval; and maintaining the clinic's ADAP and ARV database (for financial reporting and PAPs). The process involves providers completing PRT referrals indicating ARV initiation/changes; patient interviews to explain process and wait times for acquiring ARVs via ADAP vs PAPs; obtaining necessary demographics, signatures, and financial/insurance documentation; assessing for alternative reimbursement sources; and intermittent re-evaluation of financial data. Medical director support hinged on ARVs starting within a month.
RESULTS: In 1998, 450 patients were provided ARVs by PRT efforts. PAPs approval took about two weeks. Five nucleoside analogs and three protease inhibitors were accessed through five PAPs by the 2-person PRT resulting in a $1.5 million reimbursement in the form of drug/money. An estimated $25 was recovered from PAPs for every dollar spent on a reimbursement analyst's salary. A 39% reimbursement success rate was observed due to time-consuming initial PAPs set-up, negotiations to simplify PAPs, and staffing/computer system limitations. This data justified PRT expansion with an increase in staffing and additional PAPs.
CONCLUSIONS: PRTs allows unrestricted and timely access to ARVs, significantly diminishes the impact of ARVs on outpatient pharmacy budgets, and are cost effective.

157. Impact of staff pharmacists on nonadherence: addressing late antiretroviral refills. *Donna L. May, B.S.*, Susan K. Chuck, Pharm.D., Alton Condra, B.S., Edward A. Aguirre, B.S., Kay L. Woodson, B.S., Philip D. Powers, B.S., Paul E. Chamblies, B.S., Kiran Patel, B.S., Douglas E. Miller, Pharm.D.; Grady Health System, Atlanta, GA.

PURPOSE: A proactive stance by staff pharmacists (SPs) towards late antiretroviral refills (LAR) was initiated to address the problem of persistent LAR. Objectives were to evaluate the: 1) impact of SPs interventions; 2) reasons for LAR and nonadherence (NA); 3) number of educators/providers referrals; and 4) number of regimens changed/discontinued due to educator/provider referral.
METHODS: A LAR form developed by SPs was initiated for all patients ≥ 14 days late requesting antiretroviral refills. SPs interviewed patients at prescription pick up to determine reasons for LAR, suggest measures to improve adherence if feasible, and advise patients that refill records were being monitored. Adherence was re-evaluated one month later using pharmacy refill records. Patients requesting antiretroviral refills within five days of the previous month refill date were considered adherent.
RESULTS: During 7/98-7/99, 1176 LAR forms were completed with 259 (22%) patients NA. Of these, 116 (45%) were adherent the following month. Of the 42 (16%) referrals made to educators/providers, 93% resulted in regimens being changed/discontinued. In 7/99 common reasons for LAR were: NA (25%), extra supply from a known source (22%) and unknown source (20%), regimen temporarily held (7%), and regimen discontinued (5%). NA causes were: forgetting doses (20%), transportation difficulties (20%), side effects (7%), out of town (7%). Comparing 7/98 to 7/99, a 32% decrease in monthly LAR was noted but more patients admitted to NA (25% vs 16%). Educators and providers were appreciative of NA being addressed prior to the next scheduled provider visit.
CONCLUSIONS: SPs had a significant impact by decreasing LAR and addressing NA in a timely fashion.

158. The development and implementation of a multidisciplinary human immunodeficiency virus clinic at a rural family practice residency program. *David M. Hachey, Pharm.D.*, Rex W. Force, Pharm.D., BCPS, Martha Tanner, M.D., John Dickey, Ph.D., Carolyn Chaney, R.N.; Idaho State University; District VI Health Department, Pocatello, ID.

PURPOSE: To describe the development and structure of a rural multidisciplinary human immunodeficiency virus (HIV) clinic.
METHODS: The incidence of HIV is growing in rural communities around the country. A family medicine residency program in a rural state has recognized the shift of HIV from urban to rural locales and developed a federally funded multidisciplinary approach to treating HIV patients. These services include an infectious diseases physician, pharmacist, nurse case manager, clinical psychologist, and nutritionist. Patients are examined first by the physician and then by the pharmacist for medication adherence, side effects and outcomes. The case manager will see the patient for social issues and lab draws. The patient will then have an exit interview with the psychologist to evaluate the clinic visit or other issues the patient may have.
RESULTS: The current patient population includes 13 patients with a mean patient age of 28 years (range: 10 to 40) with a diagnosis of HIV for 5.4 years (range: 1 to 10). The population is 77% male and 77% of patients are on highly active antiretroviral therapy (HAART). Patients that are currently on HAART have an average CD_4 cell count of 516 /mm^3 (100% are > 200/mm^3) and 66% currently have undetectable viral loads (< 400 copies/ml). Exit interviews conducted by the psychologist indicated the following: 42% visits went very well, 47% went well, and 11% did not go well.
CONCLUSIONS: HIV care provided in a rural setting by a multidisciplinary team can be effective in managing patients with HIV and is perceived well by patients.

159. Implementation of a pharmacy-based immunization program within a health care system. *Allison T. Fox, Pharm.D.*, David A. Tjhio, Pharm.D., Janet H. Teeters, M.S.; Midwestern University, Downer's Grove, IL; Lutheran General Hospital, Park Ridge, IL.

PURPOSE: Each year, pneumococcal disease kills more Americans than all other vaccine-preventable diseases combined. Additionally, thousands are infected with the influenza virus yearly, with its primary complication being the development of pneumonia. In an effort to promote influenza and pneumococcal immunization awareness and administration, the pharmacy department of Lutheran General Hospital has instituted a pharmacy-based immunization program across its health care system.
METHODS: In 1998, one pharmacist completed an immunization certification program sponsored by the American Pharmaceutical Association. This pharmacist practiced in an outpatient anticoagulation clinic and offered influenza vaccinations only. In 1999, the pharmacy department sponsored 12 pharmacists for the same immunization certification program. These pharmacists included those who practiced in ambulatory care, inpatient infectious disease, patient education, and management. Beginning in October 1999, influenza and pneumococcal vaccinations were offered by the pharmacists in a variety of settings: an anticoagulation clinic, health system-sponsored health fairs, a nursing home, and employee health days. Pharmacists were active in screening patients for immunization eligibility, administration of vaccine, and vaccination documentation. Pharmacists also offered "brown bag" counseling sessions to patients with medication questions. Education of physicians and nurses was done to promote immunization of inpatients upon discharge. Pharmacy students from two colleges of pharmacy were also utilized in the immunization program and patient counseling.
RESULTS: During 1998, one pharmacist administered approximately 110 influenza vaccinations. Thus far in 1999, pharmacists have administered 1060 influenza vaccinations and 198 pneumococcal vaccinations to 1067 patients.
CONCLUSIONS: Within our health care system, pharmacists were able to dramatically increase influenza and pneumococcal vaccination rates.

160. Impact of a multidisciplinary surveillance team on antimicrobial utilization. *Amy Pakyz, Pharm.D.*, Katharine Schlag, N.P., W. Michael Scheld, M.D., The Antimicrobial Surveillance Team; University of Virginia Health System, Charlottesville, VA.

PURPOSE: An antimicrobial (AM) surveillance team (AST) of infectious diseases (ID) doctors and an ID clinical pharmacist was formed in May 1998 to evaluate AM therapy (Rx) on inpatients in a 590-bed university hospital.
METHODS: Patients were reviewed by AST if they received any of 14 target AM or ≥ 3 AM. Recommendations (R) were recorded in the medical record and included: concurrence with Rx, dosage adjustment, conversion to oral or monoRx, switch to narrower spectrum or less costly AM, cessation of unnecessary or prolonged Rx, and new Rx for untreated or undertreated indication. Stop orders for target AM were enforced at 72 hours.
RESULTS: Five thousand four hundred eighty-six patients were reviewed from June 1998 to September 1999. AST concurred on 30% of evaluations. On average, R were made for the following: Rx without indication (43%), nonoptimal drug (29%), nonoptimal route (12%), duplicate Rx (6%), nonoptimal dose (5%), untreated indication (2%), and clarification of indication (5%). Initially 36% of patients were receiving ≥ 3 AM concurrently. This decreased to an average of 14% after three months ($p<0.001$). On average, 59% of R were followed, 30% were not, and in 11% alternative Rx was chosen. Seventy-five percent vs 59% of R were followed on medicine vs surgery, respectively ($p<0.001$). Total cost savings for FY 99 were $267,168. Acquisition cost savings for FY 99 were $263,742.
CONCLUSIONS: An AST can effect substantial cost savings while enhancing appropriate AM Rx. Compliance with R can be improved by targeting specific AM and/or services.

161. Improving quality and decreasing cost of care through pharmacy intervention in a capitated senior population. *Nella Bieszk, Pharm.D.*, Vinay Bhargava, Pharm.D., Tony Pettita, R.Ph., MBA, Nancy Whitelaw, MSW, Ph.D., Barbara Zarowitz, Pharm.D., FCCP, BCPS; Henry Ford Health System, Detroit MI.

PURPOSE: To determine if medical history review and subsequent intervention by a pharmacist in high risk seniors (age $65, $5 medications and limited [$1000/year] prescription benefits) can: 1) increase alignment with national guidelines for asthma, diabetes, congestive heart failure, hypertension and hyperlipidemia; 2) reduce polypharmacy and medication costs.
METHODS: Data were collected prospectively from 80 randomly selected patients, serving as their own controls. The pharmacist assessed medication appropriateness and compliance through electronic medical records, paid prescription claims data and patient interviews. Recommendations were communicated to the primary care provider. Follow-up occurred after three months.
RESULTS: Of 294 patient conditions, 238 cases were in alignment with guidelines pre-intervention, 262 were in alignment post-intervention. This

represents a 10% increase in alignment (a surrogate marker for improved quality of care; p=0.001). Overall, 206 (73%) interventions were implemented. Common interventions included recommending: new drug or follow up, lower cost alternative, dosage adjustment, and drug elimination. All patients received education and compliance counseling. The average per member per month (PMPM) cost of pharmaceuticals decreased $17.04 (p=0.012) from $175.70 prior to intervention to $158.66 at three months. The average number of prescriptions PMPM decreased from 7.6 to 7.1 (p=0.001). Total cost of care, medical encounters and adverse events did not differ statistically from baseline (p=0.146, p=0.077 and p=0.672, respectively).
CONCLUSIONS: Drug regimen review and redesign was successful at optimizing the pharmacy benefit for seniors and was also able to improve quality of care.

162. Impact of proactive drug information services in a pharmacy benefit manager. *Mohammed R. Hamid, M.S.*, Dawn M. Daley, Pharm.D., Kerri K. Chitwood-Dagner, Pharm.D., Raymond R. Brown, Pharm.D., Colleen P. Duffy, B.S.; Express Scripts, Inc., Bloomington, MN.

PURPOSE: To document and evaluate the impact of proactively providing daily clinical and industry-related information via e-mail to clinical pharmacists in a pharmacy benefit manager (PBM) setting.
METHODS: Over 9 months, more than 300 drug information updates were sent to 24 clinical pharmacists who work closely with PBM clients. The updates included new drug approvals/indications, recalls/warnings/alerts, treatment guidelines, landmark studies, drug-trend reports, and managed-care news, etc. A survey (11 questions) was sent to these pharmacists to assess the benefit of this service: two questions ranked (1 [very poor] to 5 [excellent]) its usefulness and timeliness, and nine questions assessed its clinical and administrative value (yes, no, or not applicable).
RESULTS: Eighteen (75%) pharmacists responded. The updates' usefulness and timeliness were rated as excellent (72.2% and 88.8%, respectively) or good (27.7% and 11.1%, respectively); 94.4% thought the updates helped enhance their credibility with clients; 77.7% believed the updates helped them to prepare clinical presentations, enhance formulary compliance, and initiate new clinical programs; 72.2% thought the updates helped change medication policies; and 55.5% believed they were helpful in writing physician letters. This service led to a substantial clinical and/or financial impact according to 11.1% of the pharmacists; 22.2% thought it might have reduced call volume at the call center; and 16.6% said it helped them obtain new clients.
CONCLUSION: In a PBM setting, proactive, timely dissemination of clinical and industry-related information plays a key role in educating pharmacists, which in turn, increases credibility.

163. Impact of a pharmacy/nursing-driven anemia management program on hemodialysis patients of a hospital-based dialysis unit. *Adel R. Rizkala, Pharm.D.*, Edward F. Foote, Pharm.D., Peggy Protopapadakis, Pharm.D., Robin Roberts, R.N., Therese Fenton, R.N., Naomi Dahl, Pharm.D., Toros Kapoian, M.D.; Rutgers, State University of New Jersey, Piscataway, NJ; R.W. Johnson University Hospital, New Brunswick, NJ.

PURPOSE: As a part of an ongoing process improvement program at our hospital, we were charged with improving anemia in our hemodialysis outpatients. We then established guidelines for appropriate use of intravenous iron dextran and erythropoietin. The overall goal of the program was to achieve a target hemoglobin of ≥ 11g/dl in at least 80% of our patients. This program was initiated in June 1998. This study evaluated the effectiveness of this program in improving patients' anemic states and our utilization of erythropoietin.
METHODS: This chart review examined anemia parameters prior to (second quarter 1998) and after (third quarter 1999) initiation of the program. All patients who received dialysis at any point between April 1998 and September 1999 and had at least two hemoglobin values within that period of time were included in the study.
RESULTS: Mean hemoglobin values rose from 10.1 g/dl before the start of the program to 11.2 g/dl by the end of the study (p<0.005). The percent of patients at or above the target hemoglobin of 11 g/dl rose from 25.7% to 66.7% by the end of the third quarter of 1999 (p<0.001). Mean erythropoietin doses decreased from 8044 ± 4624 to 6470 ± 3750 units/dose, although this did not reach statistical significance.
CONCLUSION: The collaborative efforts of pharmacists and nurses were successful in improving our patients' anemic states. We still have not achieved our overall goal of having 80% of patients at target levels. This is an ongoing program that will continue to improve patients' health.

164. Evaluation of medication use and drug-related problems in an outpatient dialysis center: opportunity for pharmacist intervention. *Joanna Q. Hudson, Pharm.D.*, Ingrid Beierle, Pharm.D., Sergio R. Acchiardo, M.D., Kunal Chaudhary, M.D.; University of Tennessee, Memphis, TN.

PURPOSE: Complex pharmacotherapeutic regimens required in patients with endstage renal disease (ESRD) contribute to drug-related morbidity and mortality. Pharmacists' interventions have been shown to prevent medication (MED) prescribing errors and drug-related problems. MED use by patients in an outpatient dialysis center was evaluated to 1) determine MED use patterns relative to national data; and 2) identify and correct drug-related problems.
METHODS: MED reviews were conducted for hemodialysis (HD) and peritoneal dialysis (PD) patients by a pharmacist at the UTMG Dialysis Center in Memphis, TN, through patient interviews and review of dialysis records. MED usage information was compared to MED data from the U.S. Renal Data System (USRDS) 1998 Annual Data Report. Pharmacist's interventions were categorized according to specific drug-related problems.
RESULTS: One hundred fifty-five HD patients (97% black, 51% female, mean age 53.3 ± 13.3 years) and 33 PD patients (79% black, 61% female, mean age 48.5 ± 15.3 years) were interviewed.

Medication Category	HD Pts (n=155)	USRDS HD Pts (n=1998)	PD Pts (n=33)	USRDS PD Pts (n=1919)
# MEDs/pt (median)	10	8	10	8
# Doses/day (median)	19	--	19	--
# PRN MEDs/pt (median)	2	--	1	--
Phosphate Binders (% pts)	97.4	78	84.8	81
Vitamins (% pts)	92.2	64	100	67
Antihypertensives (% pts)	70.3	75	78.8	81
Erythropoietin (% pts)	85.2	83	51.5	76
Iron supplementation (% pts)	74.2	51	72.7	61
Vitamin D (% pts)	52.9	42.2	12.1	32.9
GI agents (% pts)	49.7	30	42.4	26
Estrogen replacement (% pts)	7.1	6.6	9.1	13.6
Analgesics (% pts)	49.7	12	51.5	9

A total of 216 pharmacist interventions were documented: drug without indication (18%), duplication of therapy (14.8%), drug interaction (9.3%), inappropriate dosing regimens (6.5%), therapeutic recommendations (32.9%), and miscellaneous interventions (18.5%). Nonadherence with at least one MED was identified in 53.7% of HD and 36% of PD patients.
CONCLUSIONS: MED use in this dialysis population was similar to that of the larger ESRD population. This extent of MED use is conducive to drug-related problems and patient nonadherence. Pharmacist participation in the care of patients with ESRD as demonstrated at this dialysis center may provide more rational MED use and improve adherence to therapy.

165. Pharmacist interventions in the outpatient cancer setting. *Sally L. Yowell, Pharm.D.*, Amy W. Valley, Pharm.D., Lisa M. Holle, Pharm.D.; South Texas Veteran's Health Care System, San Antonio, TX.

PURPOSE: Few published reports document oncology pharmacist interventions and outcomes. At South Texas Veteran's Health Care System, oncology pharmacists assess patients prior to chemotherapy to determine if prewritten orders may be activated and to assess overall drug therapy. However, the methods of patient assessment and documentation of interventions were inconsistent. Our purpose was to create an assessment algorithm and a progress note to standardize assessments by oncology pharmacists and to document interventions and patient outcomes.
METHODS: Between March 1 and June 30, 1999, 228 visits were evaluated. The algorithm was used for patient assessment. The visit, including interventions, toxicity assessments, communication with physicians and the drug therapy plan, was documented using a standardized progress note.
RESULTS: In the 68 patients and 228 visits evaluated, 705 interventions were documented (average: 10.4/patient, 3.1/visit). Interventions included: approving chemotherapy (28%), holding chemotherapy (3%), issuing prescriptions (24%), modifying drug therapy (20%), reporting significant events to physicians (8%), additional counseling (7%), recommending labs or tests (4%) and others (6%). Outcomes could be measured for 142 of these interventions, of which 120 were documented. Of these 120 documented interventions, 95.8% (115/120) resulted in a successful therapeutic outcome.
CONCLUSION: This report describes the activities of oncology pharmacists in an outpatient setting and the development of a standardized progress note to capture pharmacist interventions and document outcomes. Pharmacists are active participants in the care of these patients and their interventions result in successful therapeutic outcomes. Future studies will evaluate economic and humanistic benefits associated with these outcomes.

166. Documenting the value of pharmaceutical care consultations in the nuclear pharmacy setting. *Jeffrey P. Norenberg, M.S.*, Timothy S. Quinton, Pharm.D.; University of New Mexico, Albuquerque, NM; Radiopharmacy Inc., Evansville, IN.

PURPOSE: This study developed a database of radiopharmacy interventions. Further goals included identifying areas where pharmaceutical care consultations in nuclear medicine have improved patient outcomes. The specific aims of this project were to: 1) develop a reporting form and database of radiopharmacy consultations provided to nuclear medicine professionals; 2) determine the impact of the radiopharmacists' intervention on patient care; and 3) quantify cost savings to the patient, provider, institution, or pharmacy.
METHODS: A prospective survey was conducted involving radiopharmacists throughout the U.S., April 1 through December 31, 1998. Nineteen

radiopharmacists, practicing in both centralized and institutional settings, volunteered to participate in this study. Data were collected using a standardized reporting form to document consultations with nuclear medicine professionals or patients. Data analysis was performed at a centralized location. Radiopharmacists providing consultations were asked to complete a survey to obtain the following information: date, identification of requester and patient; inquiry or question posed; patient specificity; retrospective or prospective identification; responses/recommendations (with 48-hour follow up); patient outcome. Statistical analysis of the data was performed at the University of New Mexico.
RESULTS: The problems reported were categorized using published classification systems: medication related problems; altered biodistributions; imaging artifacts and anatomic variance. Two hundred sixty-five reports were received from participating radiopharmacists. Three reports received failed to state the question posed and were not included in the data analysis. Thus, 262 reports were considered complete and further evaluated.
CONCLUSIONS: A summary of the problems reported, the pharmacists' responses, and patient outcomes is presented.

167. Collaborative research with radioactive drugs. *Jeffrey P. Norenberg, M.S.*, Tamara L. Anderson, B.S.; University of New Mexico, Albuquerque, NM.

PURPOSE: The purpose of this presentation is to describe an innovative practice that has been developed using radioactive drugs in collaborative research. Since 1970, the University of New Mexico Health Sciences Center College of Pharmacy Radiopharmacy Program has collaborated with, and provided clinical research support for, investigators using radiopharmaceuticals. Recently, a small-scale manufacturing facility dedicated to the production of radiopharmaceuticals has been established. This facility operates in full compliance with current good manufacturing practices (cGMPs). In collaboration with the departments of radiology and medicine, and the division of hematology and oncology, radiopharmaceuticals for both diagnostic and therapeutic applications have been investigated in pre-clinical and phase I-III clinical studies. Some of the current capabilities, as well as highlights of recent and ongoing research of the radiopharmacists at the University of New Mexico Health Sciences Center College of Pharmacy are presented.

168. Sedation guidelines developed for pediatric ICU patients with propofol reserved for acute head trauma patients. *Maria L. Santeiro, Pharm.D.*, Daniel Riggs, M.D., Richard E. Weibley, M.D.; Tampa General Healthcare, Tampa, FL.

PURPOSE: Development of guidelines for the rational choice of sedative for pediatric ICU (PICU) patients requiring mechanical ventilation. Propofol use had steadily increased in our PICU with several adverse effects noted.
METHODS: Sedative guidelines were developed with physician and pharmacist agreement. These guidelines were implemented with sedative choice based on anticipated length of sedation. Propofol was reserved for acute head trauma patients (< 72 hours).
Residents and nursing staff were educated by the pharmacist on the guidelines listed below and copies were in each patient room. The clinical pharmacist intervened daily on rounds to assure compliance with guidelines. All sedative use was reviewed for three months pre- and post-guideline implementation.

Anticipated length of sedation (IV route unless noted):

Short term < 24 hours (non-head trauma patient) –Midazolam starting at 0.05-0.2 mg/kg/dose over 3 minutes then 0.05 mg/kg/hour; or 0.05 mg/kg/dose q0.5-2h; maximum 4 mg/dose; with or without fentanyl 1-2 µg/kg/dose q1-2h; maximum 100 µg/dose; or morphine 0.1-0.2 mg/kg/dose IV q2-4h; maximum 15 mg/dose.

Short term < 24 hours (head trauma patient [24-72 hours]) –Propofol (age > 2 years) starting at 0.2 mg/kg up to 10 mg dose; then 0.5 mg/kg/hour; if patient still agitated increase 0.5 mg/kg q 5-10 minutes; maintenance: 0.5-3 mg/kg/hour.

Moderate term 24-72 hours–Iinitiate/convert to lorazepam 0.05 mg/kg/dose q2-4h; maximum 2 mg/dose; continuous infusion for patients requiring frequent boluses; with or without fentanyl starting at 1-2 µg/kg then 0.5-1 µg/kg/hour; or morphine 0.1-0.2 mg/kg/dose q2-4h; maximum 15 mg/dose; with or without (age < 5 years) chloral hydrate 50 mg/kg/dose feeding tube (FT)/PR q6-8h; maximum 500 mg/dose.

Long term > 72 hours–Initiate/convert to lorazepam 0.05-0.1 mg/kg/dose q2-4h; maximum 2 mg/dose; continuous infusion for patients requiring frequent boluses; convert to lorazepam to FT route 0.05-0.1 mg/kg/dose q2-4h when possible; with or without morphine 0.1-0.2 mg/kg/dose q2-4h; maximum 15 mg/dose; convert to morphine FT route 0.2-0.5 mg/kg/dose q4-6h when possible; with or without (age < 5 years) chloral hydrate 50 mg/kg/dose FT/PR q6-8h; maximum 500 mg/dose.

RESULTS: Compliance with guidelines was noted in the post-implementation group with a significant reduction in propofol orders.
CONCLUSIONS: These guidelines promote a rational choice and reduce costs of sedative agents for PICU patients.

169. Pharmacist directed individualized pharmacokinetic monitoring helps to achieve therapeutic concentrations of aminoglycosides. *Lai-San Tham, M.Sc.*, Monica S K Teng, B.Sc.(Hons); National University Hospital, Singapore.

PURPOSE: This study investigated whether pharmacist directed individualized pharmacokinetic monitoring (IPM) helped in achieving target serum aminoglycoside concentrations compared to prescriber dosing preference.
METHODS: All surgical intensive care patients given aminoglycosides between July 1998 to June 1999 were enrolled. To avoid bias, data collection for the control group was completed first. Subsequent patients referred to the pharmacist for IPM, formed the therapeutic drug monitoring (TDM) group. Target peak and trough concentrations were defined according to hospital guidelines and published literature. The former was further stratified into two groups: pneumonia and non-pneumonia. Outcome measurements compared between the two groups included 1) patients that attained target peak or trough serum concentrations; 2) average daily dose; and 3) dosing interval. Statistical analysis was applied where appropriate (95% confidence interval).
RESULTS: The control and TDM groups consisted of 21 patients (22 cases) and 19 patients (21 cases), respectively. Peak concentrations were achieved in 19 (90.5%) TDM cases compared to 11 (50%) control cases (p=0.007). The corresponding results for trough concentrations were eight (38.1%) and nine (40.9%) (p=0.85). Analysis of mean peak and trough concentrations confirmed this, p=0.005 and p=0.345, respectively. The average daily doses of gentamicin and amikacin, expressed as mg/kg ideal body weight/day were comparable p=0.597 and p=0.825, respectively. The difference in dosing intervals was significant (p=0.026).
CONCLUSION: IPM enabled more peak concentrations to be attained without causing greater aminoglycosides exposure, but had no effect on trough concentrations.

170. Primary pharmacotherapeutic care clinic. *Samuel M. Fox, Pharm.D.*, Henry M. Bellamy, M.D., Camille Robinette, Pharm.D.; Department of Veterans Affairs, Salisbury, NC.

PURPOSE: This study describes the collaborative role of the clinical pharmacy specialist (CPS) and the physician in a primary care clinic. This role expands those previously described of the CPS in primary care clinics. The CPS becomes the primary provider of care for the referred disease states and is privileged to prescribe from the medical center formulary without use of protocols or countersignature.
METHODS: Primary care providers refer patients with 1) one or more diseases (hypertension, diabetes, hyperlipidemia, etc) and/or multiple drug therapy; 2) patients not reaching published goal with conventional pharmacological intervention; 3) patients experiencing adverse drug effects; and 4) patients needing narcotic analgesic withdrawal and nonnarcotic pain management. The CPS provides independent management of the patient including modifying and initiating pharmacotherapy. The CPS schedules follow-up appointments and necessary tests to evaluate success of therapy.
RESULTS: Chronic pain management: patients receiving chronic narcotics decreased 50% by the end of the first 12 months. Of remaining patients, 50% decreased their daily narcotic requirements. Hypertension: 100% of patients met goal. Pharmacological requirements decreased by at least one drug in 65% of patients. Diabetes: 60% had measured improvement (decrease in $HgbA_{1c}$).
CONCLUSION: The CPS provides the ideal extension of the physician in the primary care clinic in the management of chronic disease states. The CPS provides current standard of care for the patient in the most cost-effective manner for the medical center.

171. A new organization of the pharmacy and therapeutic committee in a French university hospital. Emmanuelle Vernotte, Pharm.D., *Sophie Jobard, Pharm.D.*, Catherine Balcon, Pharm.D., Valérie Le Jeune, Pharm.D., Gilles Piriou, Pharm.D., Philippe Lorillon, Pharm.D., Nicole Borgnis-Desbordes, Pharm.D.; University Hospital, Brest, France.

The health policy at present in hospital tends to improve the quality of health care. Pharmacists in collaboration with physicians have created the Pharmacy and Therapeutic Committee to try to optimize the use of drugs.
Before waiting for a legal definition of this committee, French hospitals have installed a local organization. Until more recently, the therapeutic committee of our hospital was organized in this manner: according to the approach subject, the pharmacists met only the most concerned physicians and the decisions were send to all physicians without any validation by the medical committee. A new pharmacy and therapeutic committee has been reorganized to reach some objectives: 1) to promote the redaction of guidelines concerning the use of drugs; 2) to develop valid evaluations of those guidelines.
The organization includes: 1) permanent members who meet every week in a pilot committee to manage the diffusion and the evaluation of the guidelines; 2) committees of specialists who meet after the demand of the pilot committee. They decide the introduction in the hospital of new drugs and criticize the written guidelines; 3) a plenary committee who meet once a year

to validate the guidelines and to set the program of the next year.

172. An innovative method of documenting and measuring pharmaceutical care activities. Wendy Gordon, Pharm.D., *Douglas Malyuk, Pharm.D.*; Royal Columbian Hospital, New Westminster, BC, Canada.

PURPOSE: An initial pilot project was carried out in the coronary care unit to develop a system of pharmacist documentation directly in the patient's health care record (HCR). The health records department retrieved this information completely and accurately when abstracting the HCR. The goal of this project was to expand the program throughout the institution and to assess the data.
METHODS: Beginning April 1, 1999 all pharmacists documented drug-related concerns directly in the progress notes of the patient HCR. Each note was coded with a number representing the pharmacist, the ward where the note was written, and a letter representing the type of intervention. Upon patient discharge, the HCR was abstracted and health records collated the pharmacy data. Reports summarizing the number of notes, the number of notes per pharmacist, the number of notes per ward, the intervention, and the case mixed group (CMG) data were generated.
RESULTS: Data obtained for the first four fiscal periods show increasing pharmacist documentation throughout the institution. The greatest number of interventions was recorded in the surgery, cardiology, and medicine areas. The most common type of intervention was dose adjustment followed by indication. No specific trends in CMG data have been identified.
CONCLUSION: The program expansion has been successful. Pharmaceutical care activity is documented in the HCR and measured by the health records department. Further development of this program will attempt to correlate these measurements to patient outcomes, patient costing and workload measurements.

173. Is clinical pharmacy fact or fiction among Saudi Arabian government hospital pharmaceutical services? *Ahmed M. Moussa, M.S.*, Ahmed R. Al-Jameel, B.S., Saeed M. Al-Ghamdi, B.S., Fuad A. Al-Janabi, B.S.

PURPOSE: This survey was conducted by the department of pharmacy services at Armed Forces Hospital, King Abdulaziz Naval Base, Jubail, Saudi Arabia to 1) document hospital pharmaceutical services; 2) determine the extent of implementing clinical pharmacy services; and 3) describe pharmacy's vision of the future and challenges for pharmacy practice.
METHODS: The surveyed 65 hospitals represented most government health district/administration in Saudi Arabia of 200 beds or higher. A questionnaire was closely modeled to the guidelines of ASHP and ACCP, mailed and then faxed three months later to each director of pharmacy of the surveyed hospitals between May 23 and November 22, 1998; ANOVA and χ^2 were used in data analysis.
RESULTS: The net response rate was 53.8%. Daily hours of ambulatory care services were 24-hour for 82.8% of the respondents and 8.6% for both 8- to 10- and 14- to 16-hour coverage. Inpatient pharmacy services showed 24-hour coverage by all respondents. The overall percentage of pharmacy staff to beds was 9.3% (5.6% pharmacists and 3.7% technicians) and 11% of hospital pharmacists holding professional graduate degrees. Some computerized pharmacy systems were found in up to 60% of the respondents. Unit dose was implemented in 82.9% of the respondents, IV admixture/parenteral nutrition service was 71.4%, and drug monitoring was 54.3%. Only 40% issued research reports while cost-effective, quality assurance and antimicrobial programs were 65.7%, 77.1%, 71.4%, respectively. Clinical pharmacy and pharmaceutical care services were 40% and 37.1% of the respondents.
CONCLUSION: Royal Cabinet, National Guard and Security Forces hospitals demonstrated the best clinical pharmaceutical services among the respondents. Amending hospitals' database is required for managing the problem of pharmacy staff shortage. It is recommended to strongly push efforts toward expanding clinical pharmacy services, pharmaceutical care, research and increasing the opportunities of pharmaceutical graduate education and training, because these efforts will be contributed to the reconstitution of the organizational structure of the hospital pharmacy practice in Saudi Arabia.

174. Utilization of physician order entry to improve community-acquired pneumonia management. *Susan L. Ravnan, Pharm.D.*, Marcus C. Ravnan, Pharm.D.; University of the Pacific, Stockton, CA; Veterans Affairs Central California Health Care System, San Diego, CA.

Approximately 100 patients (based on ICD coding) were admitted to the Veterans Affairs Central California Hospital last year with a diagnosis of community-acquired pneumonia (CAP). In the management of CAP, overprescribing of nonformulary and broad spectrum antibiotics was observed and antibiotic tracking data were presented to the pharmacy and therapeutics committee for review.
From the data presented, the pharmacy and therapeutics committee wanted to ameliorate overprescribing of non-formulary and inappropriate antibiotics, therefore community-acquired pneumonia order sets were developed. The pharmacy department developed order sets based on current CAP guidelines and local resistance patterns, to insure appropriate antibiotic selection for patients admitted with CAP. Order sets permitted physicians, via physician order entry, to order for example: CAP Ceph IV, rather than actually choosing an antibiotic. Six order sets are currently in place for CAP. The recommended first line order set for CAP is one that utilizes a third generation cephalosporin. If a contraindication to a cephalosporin exists, an order set utilizing a macrolide or fluoroquinolone antibiotic can be selected.
The development of the order sets has eliminated the prescribing of nonformulary and broad spectrum antibiotics because the physician orders pre-selected therapy, not actual antibiotics, thereby guaranteeing appropriate antibiotic utilization in CAP. Antibiotic formulary changes for CAP are more efficient. Finally clinical pharmacists are responsible for monitoring protocol utilization and outcomes, assuring accurate dosing and efficient intravenous to oral conversion of antibiotics.

175. Determining predictors for smoking cessation success in an urban, minority, low socioeconomic population. *Renu F. Singh, Pharm.D.*, Manal Elnabtity, Pharm.D., Daniel R. Touchette, Pharm.D.; Oregon State University, Corvallis, OR; Wayne State University, Detroit, MI; Detroit Receiving Hospital, Detroit, MI.

PURPOSE: We wished to assess the impact of an individually tailored, smoking cessation program in a population of largely urban minority, low socioeconomic patients. Further, we wished to see if there were specific predictors for smoking cessation success in this population.
METHODS: Twenty eight patients have been prospectively enrolled in the smoking cessation program from December 1998 to November 1999 from either self-referrals or physician referrals. This study was conducted in an ambulatory clinic at a major teaching hospital in Detroit. Patients were scheduled for 40 to 50 minute appointments with a clinical pharmacist. During this appointment the pharmacist obtained demographic, medical and nicotine addiction information from the patient with the use of a questionnaire. With this information, the pharmacist tailored a specific smoking strategy for the patient, including setting a quit date, behavioral modifications and pharmacotherapy, if deemed necessary. Willingness to purchase smoking cessation products as well as health insurance coverage of smoking cessation products was also considered in the choice of pharmacotherapy. The visit was supplemented with written material. The patient was then contacted by telephone two days after the quit date, one week after the quit date, and monthly thereafter for six months
RESULTS: Smoking cessation quit rates at the assigned quit dates, two days later, at one week, and monthly follow ups for 28 patients will be presented. Further, specific predictors and barriers for quitting success in this population will be discussed.

176. Case management of depression by clinical pharmacists in a primary care setting. *Patrick R. Finley, Pharm.D., BCPP*, Heidi R. Rens, Pharm.D., Joan T. Pont, M.D., Susan L. Gess, Pharm.D., Clifton Louie, DPA, Scott A. Bull, Pharm.D., Lisa A. Bero, Ph.D.; University of California at San Francisco, San Francisco, CA; Kaiser Permanente Medical Center, San Rafael, CA; Kaiser Permanente Division of Research, Oakland, CA.

PURPOSE: This investigation was conducted to assess the outcomes of depressed patients managed by clinical pharmacists in an integrated practice model at a staff model HMO. Clinical pharmacists provided case management services featuring medication monitoring, patient counseling, and extensive treatment follow up.
METHODS: Thirteen primary care providers were designated to refer depressed patients immediately after initiating antidepressant medications. Clinical pharmacists enrolled patients into a 6-month treatment protocol that consisted of a brief intake interview and regularly scheduled follow up (telephone contacts and clinic visits). Patients treated by 17 other providers from the same facility served as the control group.
RESULTS: Demographic variables (age, sex, medical comorbidity, etc.) were similar between the intervention group (n=91) and control group (n=129) at baseline. An intent-to-treat analysis of medication possession ratios (MPR) demonstrated that adherence was significantly higher in the intervention group (MPR = 0.81 vs 0.66; p=0.0005) and more patients had a prescription filled between months three and six (76% vs 51%; p=0.001). The intervention group expressed greater satisfaction with follow-up services, provider accessibility and overall impression of the HMO than controls (χ^2 analysis of paired data; $p<0.05$, all measures). More intervention patients also indicated they had completed six months of antidepressant (76% vs 49%; p=0.008).
CONCLUSIONS: Results from this controlled investigation suggest that case management of depression by clinical pharmacists can have a very favorable impact on medication adherence and patient satisfaction. This practice model may prove to be a valuable alternative to traditional methods of managing depression in the primary care setting.

177. Portfolio development to document fellowship equivalent learning experiences of a clinical pharmacist. *Philip D. Rolland, R.Ph.*, Mary Jo Fitz-Gerald, M.D., Guy Brannon, M.D.; Louisiana State University Medical Center, Shreveport, LA.

PURPOSE: The purpose of this project was to develop a procedure for systematically documenting the fellowship equivalent learning experiences of a clinical pharmacist as set forth by the American College of Clinical

Pharmacy fellowship peer review application.
METHODS: A requirement of this project included developing a portfolio which documented increasing competence in research, teaching and clinical practice. Documentation of learning experiences must clearly demonstrate the quality of accomplishments with tangible illustrations. The goal is to demonstrate growth through learning experience rather than repetition of an activity. This fellowship equivalent required a commitment of 80% to research, 10% to teaching and 10% to clinical practice. Sources of documentation include material from research activities, teaching and clinical practice and includes: 1) research proposal development and protocols submitted to the institutional review board (IRB); 2) methods development including selection of research instruments, equipment and material; 3) grant writing and investigator-initiated proposals; 4) presentations to residents, medical and graduate students; 5) participation in grand rounds and journal club; 6) assisting in patient assessment including history, physical, and mental status exam and attending inter-rater reliability meetings; and 7) clinical consulting in the outpatient and inpatient unit.
RESULTS: The final portfolio contained various sources of documentation including: job description, correspondence, samples of research proposals, protocols, and IRB submissions, grant applications, lecture slides and outlines, medication use criteria, consult notes, presentations, posters and publications.
CONCLUSIONS: Portfolio development is an effective method of recording learning experiences and highlighting the development of special attitudes, skills, knowledge and ability. Portfolio development is an effective method to document fellowship equivalent and other learning experiences of clinical pharmacists.

178. A step-wise approach of administration of epoprostenol therapy in patients with primary pulmonary hypertension. *Stephanie E. Cooke, Pharm.D.*, Carrie A. Schulz, Pharm.D.; Methodist Healthcare, Memphis, TN.

Due to the complex administration and extensive educational initiative needed to ensure successful delivery of epoprostenol to primary pulmonary hypertension (PPH) patients, a step-wise approach has been developed to assist caregivers. Once PPH is diagnosed and the patient meets specific criteria, the distributor of epoprostenol is contacted. A referral form is completed and submitted to the distributor with documentation confirming the patients diagnosis of PPH. The distributor will submit an application for payor coverage. The emergency/nonemergency utilization agreement and purchase order accompanies the referral form. Once confirmation of coverage is obtained the medication will be shipped. Pharmacist and nursing education is initiated with a review of the epoprostenol drug data sheet which includes preparation procedure, pharmacology, warnings, dosing, storage, stability, and administration. Acute dosing is titrated to patient response and a permanent indwelling catheter is placed. Extensive patient education is provided including medication preparation, administration, side effects, storage, and stability. Competency in catheter and catheter site care, ambulatory pump operation and troubleshooting must be demonstrated by the patient/caregiver. In addition patient must know PPH signs and symptoms and when to seek prompt medical assistance. They are also taught to monitor for signs of infection. Once competency is demonstrated by the patient/caregiver, home supplies are ordered and patient is discharged when appropriate. The distributor is available for assistance with all steps as needed. Upon any patient readmission, the pharmacist is consulted to assist with patient care. The step-wise approach allows optimal therapeutic management of a complex and life threatening disease.

179E. The outcome of patient education by the pharmacist to poorly controlled ambulatory patients with chronic respiratory disease. *Hsiang-Wen Lin, M.S.*, Sow-Hsong Kuo, M.D., Chiung-Sheue Chen, Ph.D.; National Taiwan University, Taipei, Taiwan.

180. Outcomes of a pharmacy-managed, physician-directed smoking cessation clinic in an indigent population. T. Lynn Stevenson, Pharm.D., Lauren C. Duty, Pharm.D., *P. David Brackett, Pharm.D.*, Joseph P. Liss, M.D.; Columbus Regional Healthcare System, Columbus, GA; Auburn University, Auburn, AL.

PURPOSE: This study characterizes clinical outcomes of the smoking cessation clinic to evaluate its success as a service to indigent patients and an expenditure of resources.
METHODS: Patients referred to the smoking cessation clinic were thoroughly questioned to determine smoking history and patient's readiness and desire to quit. Patients were counseled on risks and benefits of cessation and techniques to facilitate behavioral modification. Those patients committed to cessation and without contraindication or objection were started on nicotine replacement therapy (NRT) and scheduled for weekly or biweekly follow up. Twenty-seven months clinic initiation, the participants' medical records were reviewed and data concerning demographics, clinic visits, success rate, months smoke-free, use of NRT, and comorbid conditions were compiled and analyzed with descriptive statistics.
RESULTS: Patients attended a total of 307 30-minute visits during the study period. The proportion of patients remaining smoke-free was 16% and these patients had remained smoke-free for a mean of 11.8 months at the time of this evaluation. The average number of visits to the clinic was 7.9 for successes and 3.2 for failures. NRT was employed in 29 patients (10 successes and 19 failures). Common comorbidities in the clinic participants were diabetes (34%), hypertension (40%), COPD (32%) and mental illness (39%).
CONCLUSION: The smoking cessation clinic provides a valuable service to indigent patients despite a relatively low overall success rate. Expenditure of health care resources can be maximized by employing NRT, encouraging compliance, and through diligent screening to accurately identify patients in the “action” stage of cessation.

181. An Internet-based patient education tool utilizing medication pictures to overcome barriers to learning about complex transplant medication regimens. *K. Troy Somerville, Pharm.D.*, Kim Phillips, MSN, R.N., CTCC; Richard Boekweg; Jason A. Crompton, Pharm.D.; Jackie Smith, Ph.D.; University of Utah Hospitals and Clinics, Salt Lake City, UT.

PROBLEM: Long-term outcomes after transplantation require patients to be compliant with complex medication regimens. Patients often have barriers to understanding their regimens including various difficulties understanding written materials.
SOLUTION: We developed a medication planner utilizing Internet technology that provides individualized pictures of medications adding a valuable tool to our clinical services. The planner is a dynamic database providing an individualized tool with three different views to improve understanding of medication regimens. The medication planner consists of pictures, dosing intervals, and special instructions about each medication. The Pill Cup View contains actual size pictures of all the medications to be included in the pill cup at each dosing interval. The Medication Planner View shows the regimen in a concise format. And, the Medication Reference View contains a detailed reference for each medication including a picture of all available dosage forms, important potential adverse effects, and any special instructions for each medication. All transplant patients receive a color printout of all three tools upon discharge.
UTILIZATION: The medication planner has provided patients with an individualized educational tool containing actual size color pictures of their current medication regimen which can be easily updated after discharge. This tool has helped the clinical pharmacists overcome many educational barriers leading to poor compliance during the first six months of use.
FUTURE: The individualized Internet-based medication planner provides the transplant team a valuable tool to overcome patient barriers that lead to poor medication compliance and the outcome is being evaluated in an ongoing study.

182. Development and implementation of a protocol for the use of Depo-Provera® contraceptive injection in a family practice residency program/clinic. *Ila Mehra Harris, Pharm.D., BCPS*; University of Minnesota, St. Paul, MN.

PURPOSE: Although prescribing information states when Depo-Provera® contraceptive injection can be initiated, no guidelines for late administration exist. Often, patients present for Depo-Provera after the recommended 13-week interval. Waiting until the next menses is not practical because it is delayed for several months. A pregnancy test may not be accurate if intercourse occurred within two weeks. No descriptions of protocols for late injections could be found in the literature.
METHODS: A protocol was developed for our clinic. Guidelines for initiation of Depo-Provera are included, and for repeat injections to be 90-day intervals. For each injection, the patient must select from a list and sign and date the document, which is placed in the chart. For subsequent injections, if more than 90 days have elapsed, the injection will be given that day only if they have not had intercourse or used additional contraception in the previous two weeks and the pregnancy test is negative. If the criteria do not apply, the Depo-Provera is not given, and the patient is instructed to abstain or use reliable contraception for the next two weeks and return. Then, after a negative pregnancy test, the injection may be given.
CONCLUSIONS: Currently, this protocol has been in place for five months and has been well received by the physicians, patients and patient-care staff. The protocol insures that appropriate steps are taken to prevent pregnancy when Depo-Provera is administered late. The protocol and forms will be described.

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.

183. 24-hour ambulatory blood pressure monitoring in children receiving stimulant therapy for attention deficit hyperactivity disorder. Cindy D. Stowe, Pharm.D., *John D. Barksdale, Pharm.D.*, Stephanie F. Gardner, Pharm.D., Charles C. Gist, M.D., Eldon G. Schulz, M.D., Thomas G. Wells,

M.D.; University of Arkansas, Little Rock, AR.

184. Developing a limited sampling strategy for cyclosporine area-under-the-curve monitoring in lung transplant recipients. *Randall J. Dumont, B.Sc.*, Nilufar Partovi, Pharm.D., FCSHP, Robert D. Levy, M.D., FRCP(C), Guy Fradet, M.D., FRCS(C), Mary H.H. Ensom, Pharm.D., FASHP, FCCP; University of British Columbia, Vancouver, BC; Vancouver Hospital and Health Sciences Centre, Vancouver, BC; Children's and Women's Health Centre of British Columbia, Vancouver, BC.

185. Using artificial intelligence to manage chronic warfarin therapy. *Annie Shinn, B.A.*, Sian M. Carr-Lopez, Pharm.D., Timothy J. Smith, Ph.D.; University of the Pacific, Stockton, CA.

186. Improving influenza and pneumococcal immunization rates among adults receiving clinical pharmacy services in a group model health maintenance organization. *Kristi M. Miller*, Marsha A. Raebel; Kaiser Permanente of Colorado, Lakewood, CO; University of Colorado Health Sciences Center, Denver, CO.

187. Economic evaluation of trovafloxacin and levofloxacin versus ceftriaxone with azithromycin in elderly hospitalized patients with community-acquired pneumonia. *Mark D. Villmann, B.S., Pharm.D. candidate*, Leanne Lai, B.S., Ph.D., Kathleen K. Graham, Pharm.D.; Nova Southeastern University, Fort Lauderdale, FL.

188. Increasing inpatient immunization rates through a pharmacist-directed immunization program. *David M. Hachey, Pharm.D.*, Rex W. Force, Pharm.D., BCPS, Julie Johnson, Pharm.D.; Idaho State University, Pocatello, ID.

189. Correlation of patient variables to abnormal lipid profiles in hemodialysis patients. *Sonia Lin, Pharm.D.*, Amy Barton Pai, Pharm.D., Alan Lau, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

190. Evaluating long-term therapy with paricalcitol in hemodialysis patients. Amy Barton Pai, Pharm.D., *Sonia Lin, Pharm.D.*, Alan H. Lau, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

191. Effect of clotrimazole on tacrolimus pharmacokinetics in kidney transplant patients. *Grace Park Shin, Pharm.D.*, Eva M. Vasquez, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

192. Topoisomerase I modulation in a human ovarian cancer cell line (SW626) following exposure to topotecan. *Jeremy D. Flynn, Pharm.D.*, Val R. Adams, Pharm.D., Cynthia Mattingly, B.S.; University of Kentucky Medical Center, Lexington, KY.

193. The incidence of AZT-induced macrocytosis at a university hospital outpatient clinic. *Kerry L. McGarr, Pharm.D.*, Frank Romanelli, Pharm.D., Claire Pomeroy, M.D.; University of Kentucky Medical Center, Lexington, KY.

194. The impact of a pharmacy-based protocol on secondary prevention measures for patients after myocardial infarction. *Amy S. Nicholas, Pharm.D.*, Bryan F. Yeager, Pharm.D., Aimee G. Adams, Pharm.D.; University of Kentucky, Lexington, KY.

195. Construction of a five axes worksheet to facilitate patient counseling on disease states. *Mary Lewis, Pharm.D.*, Abdullah Al-Humaidan, Pharm.D., Gamal Hussein, Pharm.D.; University of Louisiana, Monroe, LA; ClinPharm International; Pharmerica at Touro Infirmary, New Orleans, LA.

196. Efficacy of metoclopramide in the treatment of postoperative ileus in critically ill patients. *Maria L. Seta, Pharm.D. candidate*, Pramodini B. Kale-Pradhan, Pharm.D.; Wayne State University, Detroit, MI.

197. The effects of cyclooxygenase-2 inhibitors on anticoagulation parameters in a VA ambulatory setting. *Monica A. Dunnam, Pharm.D.*, Tanya M. Konn, Pharm.D., Rita E. Lakamp, Pharm.D., Roberta M. Farrah, Pharm.D.; St. Louis College of Pharmacy; St. Louis John Cochran VA Medical Center, St. Louis, MO.

198. Assessing vancomycin dosing in pediatric oncology patients. *Prakash S. Naik, B.S.*, Elizabeth A. Farrington, Pharm.D., FCCP, BCPS; UNC Children's Hospital, Chapel Hill, NC.

199. In vitro stimulation of cytokine release from human peripheral blood mononuclear cells by various formulations of amphotericin B. *Jennifer Swinder, Pharm.D.*, Eric B. Hoie, Pharm.D., Brian Sandhoff, Pharm.D., Timothy R. McGuire, Pharm.D.; University of Nebraska, Omaha, NE.

200. Pharmacokinetics of cefazolin during continuous cycling peritoneal dialysis. *Omaira Meléndez, Pharm.D.*, Edward F. Foote, Pharm.D., Naomi V. Dahl, Pharm.D., Barbara L. Calvanelli, R.N., Richard A. Sherman, M.D., Toros Kapoian, M.D.; Rutgers, State University of New Jersey, Piscataway, NJ; Robert Wood Johnson Medical School, New Brunswick, NJ; DCI/RWJ Dialysis Center, North Brunswick, NJ.

201. The prevalence of angiotensin converting enzyme inhibitor use in diabetic patients. *Xue Min Huang, B.S., Pharm.D. candidate*, Sharon See, Pharm.D., James Mumford, M.D.; St. John's University, Jamaica, NY; Beth Israel Medical Center, New York, NY.

202. Efficacy of alteplase for use in catheter clearance. *Katherine M. Greenlee, Pharm.D.*, Anthony T. Gerlach, Pharm.D., Kerry K. Pickworth, Pharm.D., Marva M. Tschampel, R.Ph.; Ohio State University, Columbus, OH.

203. Liposomal formulations of amphotericin B: cost analysis for formulary decision making. *Julie Thomas, Pharm.D.*, Susan S. Kim, Pharm.D.; Thomas Jefferson University Hospital, PA.

204. The clinical application of free phenytoin levels in Puerto Rican veterans. *Lucía M. García, Pharm.D. candidate*, Mitchell Nazario, Pharm.D., Leanne Lai, Ph.D., Yolanda Meléndez, M.S., MT, (ASCP); San Juan Department of Veterans Affairs Medical Center, San Juan, Puerto Rico; Nova Southeastern University, Fort Lauderdale, FL.

205. Effect of HMG CoA reductase inhibitors on fluconazole activity against *Candida albicans*. *James D. Nash, Pharm.D.*, David S. Burgess, Pharm.D., Robert L. Talbert, Pharm.D., FCCP, BCPS; South Texas Veteran's Healthcare System, San Antonio, TX; University of Texas Health Science Center, San Antonio, TX; University of Texas, Austin, TX.

206. Effect of body weight on subcutaneous vitamin K administration in over-anticoagulated patients. *Kevin C. Kelly, Pharm.D.*, Rick A. Weideman, Pharm.D., BCPS, Guna Raj, M.D.; Dallas Veterans Affairs Medical Center, Dallas, TX.

207. Development of ICU sedation guidelines to minimize use of propofol: a student perspective. *Bess F. Kamikawa, Pharm.D. candidate*, Maureen R. Prather, Pharm.D., BCPP, Gregory A. Matsch, Pharm.D., BCPS; Washington State University, Federal Way, WA; Pfizer Inc., Tacoma, WA; MultiCare Medical Center, Tacoma, WA.

208. Patient-specific sensitivity factors and metabolic characteristics of patients with very low warfarin dosing requirements. *L. Midori Kondo, Pharm.D.*, Ann K. Wittkowsky, Pharm.D., Mitch Higashi Ph.D., David Veenstra Ph.D.; University of Washington Medical Center, Seattle, WA; University of Washington, Seattle, WA.

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