ABSTRACTS

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American College of Clinical Pharmacy
European Society of
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International Congress on
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April 11–14, 1999
Disney's Coronado Springs Resort
Orlando, Florida

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

ORIGINAL RESEARCH

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

Administration

1. Characteristics of hospitals using a university-based drug information center. *Linda R. Young, Pharm.D.*, Peter A. Chyka, Pharm.D., Lori N. Justice, Pharm.D., Julie L. Muller, Pharm.D.; University of Tennessee, Memphis, TN.

PURPOSE: The study objective was to characterize hospitals utilizing a university-based drug information center (DIC) under contract.
METHODS: A pharmacy management company contracts with the DIC to provide drug information as an elective benefit to member facilities. In May 1997, a survey was mailed to facilities eligible to use the service (n=296) to determine reasons for utilizing the DIC and how the information was used. The AHA guide to the health care field was consulted to determine hospital governance, service, medical school affiliation, teaching hospital status, average daily census, and critical care services. To be included in the study, documentation by the DIC that the respondent had called the center and availability of selected AHA data was required. Statistical analysis included chi squared and Fisher's exact tests, with a significance level of 0.05.
RESULTS: Of 296 eligible hospitals, 175 used the DIC the preceding year. Sixty percent (64 of 106) of responses met inclusion criteria. Seventy-five percent of respondents were nongovernmental, not-for-profit, general medical-surgical hospitals. Ninety-eight percent had at least one critical care service. The daily census was 83.9 ± 69 (mean ± SD). Reasons for calling the DIC (percentage of respondents) were lack of references (73.4%), lack of time (42.2%), confirmation of an unfamiliar topic (40.6%), staff shortage (18.8%), and easy access (29.7%). None of these reasons showed a significant association with the selected AHA data.
CONCLUSIONS: A typical facility using these contracted DIC services was characterized, but independently reported hospital characteristics were not associated with reasons for using DIC services.

Adverse Drug Reactions/Drug Interactions

2. Drug-related problems in an emergency department in a tertiary care hospital in Spain. *L. Tuneu Valls*, M. Garcia Pelaez, S. Lopez, G. Serra, C. de Irala, R. Tomas, J. Ramos, J. Bonal; Hospital de Sant Pau, BCN, Spain.

PURPOSE: The frequency of drug-related problems (DRP) has been assessed in multiple studies, most of which have been done in U.S. hospitals. DRP have been reported to account for a range from 0.2-21.7%. This high variability depends mainly on DRP's definition, patients demography, and detection methods used. For instance, most of the studies have focused on the detection of adverse drug reactions, or were retrospective, relying on physician documentation. Nevertheless, no one in Spain has analyzed the frequency of DRP which are responsible for emergency department (ED) visits.
METHODS: This prospective study involved patients who visited the ED of a 1000-bed university hospital during 6 days from October 1997 to May 1998. During each day (24-hour shift) a pharmacist was in the ED. Demographic characteristics and medical and pharmacologic histories were recorded about each patient. We also assessed the compliance and medication knowledge of patients using specific questionnaires. We used DRP's Strauss classification.
RESULTS: We have seen 636 patients, and of these, 220 were excluded due to voluntary discharge (7), no medication (146), derivation to another hospital (47), and no information (20). There were 416 patients included, 121 of which had a DRP (29%). Of these 121 DRP, only 81 justified visiting the ED. The main types of DRP were adverse drug reaction (32%), inappropriate indication (29%), dosing schedule (16%), noncompliant (9%), drug interaction (7%), and voluntary drug intoxication (7%).
CONCLUSION: The frequency in DRP in our ED is very high, especially due to the mean age of the visited patients who are elderly with a long pharmacologic history.

3. Investigation of the causes, and financial and clinical implications, of drug-related admissions. J. Graham Davies, MRPSGB, Ph.D., *Elma J. Still, MRPSGB, PG Dip*, Yvonne D. Baily, B.S.; University of Brighton, Elm Grove, Brighton, United Kingdom.

PURPOSE: Preventable causes of drug-related hospital admissions (DRHA) can be targeted to improve the effective delivery of pharmaceutical care. This study aimed to identify and categorize DRHAs in a 700-bed acute hospital.
METHODS: Prospective data were collected from medical notes and patients interviewed for admissions over a 1-month period. The admissions were reviewed by an expert panel (two senior pharmacists and the consultant chair of the formulary committee) and assigned as definite, probable, and possible DRHAs. DRHAs were further classified as preventable or not preventable. Factors influencing DRHAs were evaluated using statistical programs for the social sciences. The bed day cost analysis of DRHAs was undertaken.
RESULTS: Data were randomly collected from 67 admissions over the 1-month period. The incidence of definite, probable, and possible DRHAs was 7 (10.4%), 7 (10.4%), and 8 (11.9%), respectively. Five of the seven definite DRHAs were classified as preventable. Drug interactions and adverse effects were responsible for 12 admissions, seven by inappropriate prescribing and three as a result of poor adherence by patients with prescribed medication. No significant correlation was found between age, sex, and type of admission, but the number of medications was identified as a factor. The financial implications of DRHAs during the study period was estimated to be £126,807.
CONCLUSION: Drug-related admissions are debilitating to patients and costly to the Health Service. As a result of this study, an educational program will be developed for doctors in general practice focusing on the causes of DRHAs.

4. Association of vitamin B_{12} injections with long-term acid suppression therapy. *Angie Meeker, Pharm.D. candidate*, Rex W. Force, Pharm.D., BCPS, Paul S. Cady, Ph.D., Vaughn L. Culbertson, Pharm.D., Craig Kelley, B.S., Wendy S. Force, B.S.; Idaho State University, Pocatello, ID.

PURPOSE: Proton pump inhibitors (PPI) and H_2-blockers (H2B) have been used to treat various GI conditions. However, long-term acid suppression therapy (LTAST) may have adverse consequences. Vitamin B_{12} malabsorption may be one of these consequences. The primary objective of this study is to determine if there is an association between administration of B_{12} injections and LTAST.
METHODS: Patients were identified retrospectively by paid Medicaid prescription claims. Cases were defined as those patients who received their first B_{12} injection during the 2-year study period. The index date was defined as the date of first B_{12} injection. LTAST was defined as at least 10-12 months of therapy with PPI and/or H2B in the 12 months prior to the index date of the case patient. Four control patients, who never received a B_{12} injection, were matched to each case based on gender and age. Case and control exposure to LTAST was analyzed by chi squared analysis.
RESULTS: Of the 109,844 Medicaid patients who had prescriptions filled between September 27, 1995 and September 27, 1997, 125 received their first B_{12} injection during the study period. Of these 125 patients, 23 (18.4%) received LTAST, as compared with 56 of 500 (11.2%) in the control group ($p<0.05$) with an odds ratio of 1.79 (95% CI = 1.06 to 3.02).
CONCLUSION: In this retrospective case-control study, patients who initiated B_{12} therapy were significantly more likely to have received long-term acid suppression therapy in the prior year as compared with gender and age matched controls.

5. Significant metoprolol/diphenhydramine pharmacokinetic and pharmacodynamic interaction. *Bettina Hamelin, Pharm.D.*, J. Méthot, M.S., S. Pilote, M.S., P. Poirier, M.D., J. Dumesnil, M.D., J. Turgeon, Ph.D.; Quebec Heart Institute; Université, Ste-Foy, PQ, Canada.

PURPOSE: We have demonstrated that diphenhydramine (DPH) is a mixed inhibitor of the polymorphic P450 isozyme CYP2D6 in vitro. The current study was undertaken to investigate in vivo whether DPH modulates the pharmacokinetics and pharmacodynamics of the CYP2D6 substrate

metoprolol (MET).
METHODS: This was a double-blind, crossover, placebo controlled study of 16 volunteers with high (n=10; EM) or low (n=6; PM) CYP2D6 activity. Each volunteer received a single oral dose of MET (100 mg) on two occasions (i.e., on the third day of a 5-day course of either 50 mg DPH TID or placebo). On the study day, heart rate (HR), systolic blood pressure (SBP), and Doppler-derived aortic blood flow peak acceleration (PkA) and velocity (PkV) were assessed on eight occasions during standardized exercise. Blood and urine were collected 48 hours following the MET dose.
RESULTS: Pharmacokinetic data derived using compartmental and noncompartmental analysis were:

		AUC (Met) (ng•h/ml)	AUC (OH-Met) (ng•h/ml)	$t_{1/2}$ (h)	Cl_o (L/hr)	Cl_{ren} (L/hr)	$Cl_{Met/EOH}$ (L/hr)
EM	Met/placebo	914 ± 407	1003 ± 222	2.7 ± 0.4	130 ± 56	6 ± 2	16 ± 8
	Met/DPH	1453 ± 432	851 ± 189	3.7 ± 0.8	73 ± 18	6 ± 2	7 ± 3
PM	Met/placebo	3818 ± 975	57 ± 60	7.2 ± 0.5	28 ± 9	6 ± 2	0.09 ± 0.01
	Met/DPH	4374 ± 1108	86 ± 79	7.5 ± 0.6	24 ± 6	5 ± 1	0.07 ± 0.03

$AUC_{0-\infty}$ of metoprolol was 59% higher and AUC_{0-48h} of α-OH-MET was 15% lower in EMs on DPH compared to placebo. Changes in AUC were reflected by a 44% decrease in oral clearance, a 56% decrease in partial metabolic clearance, and a 37% increase in $t_{1/2}$. Furthermore, changes in pharmacokinetics resulted in a prolongation of metoprolol hemodynamic effects (i.e., decreases in HR, SBP, PkA, and PkV lasted longer in EMs on DPH compared to placebo). No significant differences were observed in metoprolol pharmacokinetic or pharmacodynamic parameters in PMs receiving either co-treatment.
CONCLUSION: Co-administration of the over-the-counter H_1-receptor antagonist DPH with metoprolol resulted in a significant interaction. This study suggests that DPH may cause clinically relevant drug interactions, in particular with CYP2D6 substrates having a narrow therapeutic index.

6. The effect of the moderate consumption of olestra in patients stabilized on warfarin. *Nick P. Beckey, Pharm.D., BCPS*, Lisa B. Korman, Pharm.D., David Parra, Pharm.D.; Veterans Affairs Medical Center, West Palm Beach, FL.

PURPOSE: To assess the effects of the moderate consumption of olestra containing snacks in a randomized, double-blind, placebo controlled fashion in patients stabilized on warfarin.
METHODS: Patients on chronic warfarin therapy with two consecutive international normalized ratios (INRs) within the therapeutic range were considered for inclusion. Participants were provided with seven servings containing 1.5 servings (42 grams) each of the assigned study product and instructed to consume one serving daily for 1 week, at which time they returned to clinic for an INR and an additional week's worth of study product. Patients were monitored at baseline, week 1, and week 2 for any side effects to the study product or changes in the INR. If the participant's INR was outside the therapeutic range at week 1 they were withdrawn from the study and corrective action was taken.
RESULTS: Thirty-six patients completed the first week of the trial, 18 patients in each group. After 1 week, the mean change in the INR from baseline was similar for both groups. The INR increased by 0.02 ± 0.5 in the olestra group and by 0.17 ± 0.4 in the placebo group (p=0.327). Ten patients in the olestra group and 12 patients in the placebo group completed the second week of the trial. The mean INR change from baseline was also similar at week 2 for these patients, -0.18 ± 0.38 versus 0.09 ± 0.53 (p=0.193) in the olestra and placebo groups, respectively. Gastrointestinal side effects (diarrhea, gas, bloating) occurred in three patients in the olestra group and five patients in the placebo group (p=0.3).
CONCLUSION: The moderate consumption of olestra-containing snacks daily for 2 weeks did not result in a significant change in the INR when compared to snacks that did not contain olestra. The incidence of gastrointestinal side effects was also similar for both groups.

7. Pharmacy-managed program evaluating the safety of intramuscular influenza vaccine in patients treated with warfarin. *Julie A. Chapman, Pharm.D.*, V. Lee Holmes, Pharm.D., Susan Spivey-Miller, Pharm.D.; Veterans Administration Medical Center, Gainesville, FL.

PURPOSE: There is conflicting evidence in the literature with regard to the significance of the drug interaction between warfarin and the influenza vaccine. This study was designed to determine the degree of this interaction and the risk of hematoma formation associated with an intramuscular (IM) injection in anticoagulated patients.
METHODS: One hundred thirteen adult patients receiving chronic warfarin therapy had an international normalized ratio (INR) drawn prior to administration of influenza vaccine (INR-1) and within 14 days post-vaccination (INR-2). Differences were assessed by the Wilcoxan signed rank test. Signs of bleeding at the injection site were assessed at both visits and analyzed using McNemars statistical test.
RESULTS: There was no significant difference between INR-1 and INR-2 (p=0.161). There were no clinically detectable local bleeding complications after the IM injection and no major or minor bleeding episodes 14 days post-vaccination.
CONCLUSIONS: Multiple controversies have surrounded IM administration of influenza vaccine to patients receiving chronic warfarin therapy. Two concerns raised include the safety of an IM injection in the anticoagulated patient and the potential drug interaction between warfarin and the influenza vaccine. The Centers for Disease Control and Prevention and all influenza manufacturers recommend that vaccine be given IM to ensure that proper titers are reached systemically. Based on the size and results of this study, influenza vaccine appears to have no significant effect on the INR in stable chronic warfarin patients and can be considered safe in this patient population.

8. Quantitative analysis of the amiodarone-warfarin interaction. *Brian K. Plowman, Pharm.D., BCPS*, Thu-Mai Duong, Pharm.D.; Veterans Affairs San Diego Healthcare System, San Diego, CA; University of the Pacific, Stockton, CA.

PURPOSE: To quantitate the effect of amiodarone therapy on warfarin dosing in the elderly population, identify the period of time in which this interaction may occur, and evaluate the need for prophylactic reduction in warfarin dosing.
METHODS: Patients who were concurrently receiving amiodarone and warfarin therapy for atrial fibrillation or atrial flutter were identified from the clinical inpatient anticoagulation monitoring program. Forty male patients averaging 67.7 ± 9.4 years of age, requiring a mean of 5.20 ± 2.03 mg/day of warfarin, with a mean initial international normalized ratio (INR) of 2.31 ± 0.41, were evaluated. All patients enrolled into the study were stable on their current warfarin regimens prior to the initiation of amiodarone therapy. All patients received amiodarone dosing via an 800 mg loading dose followed by a maintenance dose of 200 mg/day. Patient's warfarin doses were not adjusted until the interaction had occurred, rather than a prophylactic reduction in warfarin dosing upon the initiation of amiodarone therapy.
RESULTS: The mean reduction in maintenance warfarin dosing (mg/day) before and after amiodarone therapy was initiated was 5.20 ± 2.03 and 3.26 ± 1.47, respectively (p<0.001). The mean elevation in INR (units) before and after amiodarone therapy was 2.31 ± 0.41 and 4.12 ± 1.57, respectively (p<0.001). The average time to the interaction was 9.61 ± 10.94 days (median of 4.5 days).
CONCLUSIONS: Reducing the warfarin dose once the INR becomes supratherapeutic, the wait and watch approach, is both a safe and effective method of handling the amiodarone-warfarin interaction.

9. Validation of computer screening criteria in identifying preventable drug-related morbidity. *Scott A. Neel, Pharm.D.*, Neil J. MacKinnon, M.S., Charles D. Hepler, Ph.D., Lisa C. Hutchison, Pharm.D., BCPS; Florida Hospital, Orlando, FL; Du Bow Family Center for Research in Pharmaceutical Care.

PURPOSE: Geriatric patients represent only 12.5% of the population yet account for 36% of total health care expenditures. In the environment of limited health care resources, it is of increasing importance to prevent unnecessary expenditures for hospitalization and physician visits. The purpose of this study was to validate a strategy for identifying preventable drug-related morbidities (PDRM) using expert panel-proposed definitions of PDRM, computer screening of ICD-9 codes, and medication utilization.
METHODS: This study included geriatric patients enrolled in a hospital health plan. Using ICD-9 codes for myocardial infarction and diabetes, and medication utilization records, a computer database search identified patients with possible PDRMs. Hospital chart reviews were conducted and then reviewed by an expert panel of five clinical pharmacists. Patients were classified as either having or not having a PDRM. The two criteria were secondary myocardial infarction without aspirin and β-blocker (n=35), and hospitalization due to hyperglycemia for patients taking hypoglycemic medications without regular HgA_{1c} monitoring (n=31).
RESULTS: The pharmacist review validated the PDRM identification strategy. The sensitivity of the computer search was 64.8% and the specificity was 83.3%. The agreement between the five reviewing pharmacists was very high.
CONCLUSION: This study showed that screening for PDRM by computer search, using the operational definitions of these two PDRMs, is valid. Use of a computer search, based on these definitions, may help to improve pharmaceutical care interventions and prevent unnecessary admissions.

10. Elevation of INR in hospitalized patients due to a warfarin and clarithromycin interaction. S. Gary Albert, B.S., MBA, *Sheree M. Schmidt, Pharm.D.*, Kristin C. Oberg, Pharm.D., BCPS; Brigham and Women's Hospital; Northeastern University, Boston, MA.

PURPOSE: It is well documented that additional elevations in international normalized ratio (INR) occur with concurrent erythromycin and warfarin therapy. Initial safety data suggested that newer macrolides may have less propensity to elicit interactions with warfarin. Case reports of INR increases following the addition of clarithromycin therapy to patients on warfarin suggest a potential interaction. The study purpose was to perform a cursory investigation of effects of clarithromycin on anticoagulated patients.
METHODS: We performed an observational study of computerized hospital records from March 1998 to September 1998 to identify patients receiving

clarithromycin. Profiles were then screened for hospitalized patients on concomitant warfarin. Patients were evaluated only if their INRs were stable prior to initiation of clarithromycin, and had at least one INR documented on a subsequent day. Demographics, treatment course, and INR values were collected. INR values following a therapeutic intervention were not included in the data collection.
RESULTS: Of 448 patients on clarithromycin therapy, 47 (11%) also received warfarin therapy. Of these, only 10 (2%) patients (three men, seven women) met inclusion criteria. INRs observed through eight days of combination therapy were:

	Baseline	Day 1	Day 2	Day 8
Mean ± SD	2.1 ± 0.6	2.5 ± 0.9	2.8 ± 0.8	5.9 ± 2
Median	2.1	2.5	2.8	5.9
Mean % Δ INR		17%	59%	185%

CONCLUSION: Increased INRs were observed as early as days 1 and 2 of concomitant therapy. Because trends in extreme INR elevations were observed after several days of concurrent clarithromycin and warfarin, we are particularly concerned about the patient with clinically relevant INRs occurring after hospital discharge. Further controlled clinical trials are needed to substantiate this interaction.

11. Developing consensus on definitions of preventable drug-related morbidity using the Delphi technique. *Neil J. MacKinnon, M.S.*, Charles D. Hepler, Ph.D., Lisa C. Hutchison, Pharm.D., BCPS, Paul Garrett, M.D.; DuBow Family Center of Research in Pharmaceutical Care; Florida Hospital, Gainesville, FL.

PURPOSE: Drug-related morbidity and mortality is an important problem in health care today. Despite this, there is no agreement on which drug-related morbidities are preventable. The purpose of this study was to create an operational definition of preventable drug-related morbidity (PDRM).
METHODS: A survey was constructed, listing the clinical outcome and pattern of care related to possible PDRMs in older adults. Using the Delphi technique, a geriatric medicine expert panel of six physicians and one pharmacist were asked to judge whether the outcome was foreseeable, recognizable, and whether causality was identifiable and controllable. If all four conditions were met, it was judged to be a PDRM. Two rounds of the Delphi technique were used until consensus was obtained.
RESULTS: Forty-eight possible PDRMs were initially presented to the geriatric medicine expert panel. After the first round, two possible PDRMs were dropped and 12 were added. After the second round, 52 outcomes and patterns of care were judged to be PDRMs. The consensus was very high; after round 2, the experts agreed that 82.8-100% of the outcomes and patterns of care were PDRMs.
CONCLUSIONS: This study showed that consensus on an operational definition of PDRM can be reached among experts. Prior to this, few authors have explicitly described the standard that they used in judging events as preventable. By developing explicit operational definitions of PDRM, this research project will advance the development of improved standards of care.

12E. Calcium channel blocker-induced esophageal reflux. *Jeffery D. Hughes, B.Pharm., M.Pharm.*, Toby Keall, B.Pharm., Trihn Nguyen, B.Pharm., Rebecca Paterson, B.Pharm.; Curtin University of Technology, Perth, Australia.

Presented at the Western Australia Branch of the Society of Hospital Pharmacists of Australia Conference, Perth, Western Australia, August 1998.

Analgesia

13. Evaluation of rectal and oral acetaminophen in postoperative regimens: serum and saliva concentrations. *Tina W. Hahn, M.S.Pharm.*, Torben Mogensen, M.D., Ph.D., Claus Lund, M.D., Ph.D., Lars Schouenborg, M.D., Mette Rasmussen, M.S.Pharm., Ph.D.; The Royal Danish School of Pharmacy; Copenhagen University Hospital, Copenhagen, Denmark.

PURPOSE: 1) To examine the pharmacokinetics and pharmacodynamics of acetaminophen after rectal and oral administration for postoperative pain treatment. 2) To examine the correlation between serum and saliva concentrations of acetaminophen.
METHODS: Twenty-five women undergoing minor gynecologic laparoscopic surgery were given 2 x 1 g acetaminophen suppositories after surgery followed by 2 x 500 mg acetaminophen tablets after 4 and 8 hours. Alfentanil was available as an escape pain medication, if the patients were in pain, administered via infusion pump. Blood and saliva samples were collected at scheduled times. Patients' self-reported pain was obtained using a 100 mm visual analogue scale (VAS).
RESULTS: Four hours after administration of the rectal dose, the mean concentration was 8.3 ± 0.73 mg/L. Only four patients had reached the maximum concentration (C_{max}) after 4 hours. After the oral administrations, concentrations were 15.3 ± 1.7 mg/L, 16.0 ± 1.6 mg/L, and 21.4 ± 2.0 mg/L at 5, 8, and 9 hours, respectively. The VAS scores dropped from 4.8 immediately after the end of anesthesia to 0.8 (median values) at the end of the 9-hour observation period. The median number of alfentanil doses declined from three to none during the observation period. The saliva/serum ratio approximated 1.0 with correlation coefficients (r^2) of 0.96 (rectal) and 0.81 (oral).
CONCLUSIONS: The absorption was slow after administration of 2 g acetaminophen suppositories and the serum concentrations were not higher than concentrations reported in the literature after administration of 1 g suppositories. A good correlation between saliva and serum concentrations of acetaminophen was found.

Cardiology

14. The effect of hypoxia on atrial natriuretic peptide in patients with obstructive sleep apnea. *Bradley G. Phillips, Pharm.D.*, Masahiko Kato, M.D., Krzysztof Narkiewicz, M.D., Ph.D., Catherine C. Pesek, D.O., Mark E. Dyken, M.D., Virend K. Somers, M.D., Ph.D.; University of Iowa, Iowa City, IA.

PURPOSE: Atrial natriuretic peptide (ANP) has potent natriuretic, diuretic, and vasorelaxant properties. Acute and chronic hypoxia is a powerful stimulus for ANP release. The relationship between ANP and hemodynamics in obstructive sleep apnea (OSA) is poorly understood. We evaluated hemodynamic and ANP responses following untreated OSA and the effects of successful nasal continuous positive airway pressure (CPAP) therapy.
METHODS: Mean arterial pressure (MAP) and plasma ANP measurements in 20 patients (age 55 ± 3 years) with OSA were made prior to sleep (10 p.m.), following untreated sleep apnea (2 a.m.), and upon waking (7 a.m.) after 5 hours of successful CPAP therapy. Similar measurements were obtained in ten control subjects (age 47 ± 3 years) who were free of sleep disturbances.
RESULTS: Patients and controls were matched for age, sex, and MAP. In patients with OSA, MAP and ANP significantly increased following approximately 4 hours of untreated sleep apnea and significantly decreased after successful CPAP therapy. MAP in controls fluctuated in the opposite direction ($p<0.005$) with ANP remaining relatively unchanged throughout the night.

	Patients (n=20)		Controls (n=10)	
	MAP (mm Hg)	ANP (pg/ml)	MAP (mm Hg)	ANP (pg/ml)
10 p.m.	103 ± 3	41 ± 8	95 ± 3	46 ± 9
2 a.m.	108 ± 2†	64 ± 10†	84 ± 3†	48 ± 7
7 a.m.	99 ± 2†	43 ± 6†	89 ± 3†	43 ± 7

mean ± SEM; † $p<0.05$

CONCLUSION: In untreated OSA, ANP levels are elevated in concert with MAP; successful CPAP therapy attenuates these responses. Hypoxia, in part, may trigger the release of ANP in patients with OSA.

15. Impact of a pharmacist-directed clinic on the medical management of patients with coronary artery disease. *Deborah J. Partsch, Pharm.D.*, Kjel A. Johnson, Pharm.D., Kathleen Taylor, B.S.N., Linda V. Goodman, M.P.H., William Hignett, M.P.H., Thomas Graboys, M.D., Kirk Musselman, M.D.; HealthAmerica of Pennsylvania Inc.; University of Pittsburgh, Pittsburgh, PA; Integrated Therapeutics Group; Lown Cardiovascular Center; Harvard Medical School; Allegheny University Medical Practice.

PURPOSE: To assess the impact of a pharmacist-directed clinic on the medical management of ambulatory patients with coronary artery disease (CAD).
METHODS: Patients having medical record documentation of CAD were randomly recruited from nine medical offices (five treatment, four control). Lipid profiles and medical histories were recorded at baseline and 14 weeks. Treatment group subjects were counseled by a pharmacist regarding their medications, nutrition, exercise, and cholesterol values at baseline and 14 weeks. Treatment primary care physicians (PCPs) received lipid levels and pharmacotherapy recommendations based on published guidelines for optimal medical management including aspirin, β-blockers, HMG CoA reductase inhibitors (HMGs), and hormone replacement therapy (HRT) for post-menopausal women. Control subjects received usual care from their PCPs. Data were evaluated for between and within group differences.
RESULTS: Four hundred twenty-five patients were enrolled; 379 completed the program (198 = treatment, 181 = control). There were no differences in age (mean 62), gender (71% male), or disease severity between groups. Treatment group aspirin use at 14 weeks increased 13% (88%, $p<0.01$) and was higher than controls (77%, $p<0.01$). Beta-blocker use did not significantly change in the treatment or control group. Treatment group HMG use at 14 weeks increased 25% (68%, $p<0.01$) and was higher than controls (53%, $p<0.01$). Treatment group HRT use at 14 weeks increased 25% (54%, $p=0.30$) and was higher than controls (30%, 21% reduction, $p=0.01$).
CONCLUSIONS: A pharmacist-directed clinic increased aspirin, HMG, and HRT utilization in patients with CAD versus patients receiving usual care.

16E. Impact of clinical pharmacist-based intervention on outcomes in congestive heart failure. *Aileen B. Luzier, Pharm.D.*, Brad Robison, M.D., Stephen G. Feuerstein, Jerome J. Schentag, Pharm.D., Joseph L. Izzo, M.D.; State University of New York at Buffalo; CGF Health Systems, Buffalo, NY.

Presented at the Annual Meeting of the American Society for Clinical Pharmacology and Therapeutics, San Antonio, TX, March 1999.

17. The impact of low dose intra-operative magnesium sulfate administration on the incidence of atrial fibrillation in post-operative coronary artery bypass surgery patients. *Michael Shara, Pharm.D., Ph.D.*, Thomas Langdon, M.D.; Creighton University; Alegent Health Immanuel Medical Center, Omaha, NE.

PURPOSE: This study was carried out to determine the impact of low dose (1.5 g) magnesium sulfate ($MgSO_4$) administration on the incidence of post-operative atrial fibrillation (POAF) in patients undergoing coronary artery bypass (CAGB) surgery.
METHODS: Fifty-two of 105 patients undergoing CABG surgery received an intravenous solution consisting of 1.5 g $MgSO_4$ in 50 ml of 5% dextrose intra-operatively. The 53 patients in the control cohort group did not receive $MgSO_4$. The incidence of POAF for the two groups was documented.
RESULTS: Fourteen out of 52 patients developed POAF in the group receiving the $MgSO_4$, compared to 16 of 53 in the group not receiving the $MgSO_4$. A non-statistically significant ($p>0.05$) 4.4% reduction in the incidence of POAF was observed in the group of patients receiving the $MgSO_4$.
CONCLUSIONS: These findings indicate that the intra-operative administration of a single 1.5 g of $MgSO_4$ dose results in a small non-statistically significant decrease in the incidence of POAF. Others have reported significant reductions in the incidence of post-operative cardiac arrhythmias, including atrial fibrillation, in patients undergoing CABG surgery treated with $MgSO_4$. However, these studies utilized much higher doses of $MgSO_4$, employing various protocols most often including the administration of a bolus dose followed by a continuous infusion for various time intervals, in some studies up to several days. Although significant reductions were observed in these studies, the patients required vigorous monitoring, including frequent serum magnesium concentration assessment. Further study is warranted to determine the optimal cost-effective utilization of $MgSO_4$ therapy.

18. Loop diuretic effectiveness for the treatment of heart failure: the first 24 hours. *Barry E. Bleske, Pharm.D.*, Jennifer Leung, Pharm.D., Bruce W. Chaffee, Pharm.D.; University of Michigan, Ann Arbor, MI.

Patients with congestive heart failure (CHF) are often admitted to the hospital in a fluid overload state. Furosemide is used initially to treat patients due to low cost. However, there are limited data evaluating the cost effectiveness among loop diuretics.
PURPOSE: Evaluate the cost effectiveness of furosemide (F), bumetanide (B), and torsemide (T) in treating CHF in a university hospital over the initial 24 hours.
METHODS: A retrospective chart review of all patients admitted with the diagnosis of CHF who were administered intravenous loop diuretics was conducted. Effective diuresis was defined as a net urine output (fluid in minus fluid out) more than 750 ml/24 hours. Cost-to-effectiveness (CE) ratio was defined as cost/100 ml net urine output/24 hours. Acquisition cost ratio for F:B:T was 1 to 3.6 to 1.34.
RESULTS: A total of 83 patients were included in the study (31 F, 31 B, and 21 T). Baseline demographics were similar among the groups. The mean doses for F, B, and T was 166 ± 211 mg, 13 ± 11 mg, and 125 ± 111 mg, respectively. Net urine output for F, B, and T were 1097 ± 1918 ml, 2079 ± 2152 ml, and 1958 ± 1452 ml ($p<0.09$ F and T vs B). Effective diuresis was obtained in 19%, 42%, and 62% of patients for F, B, and T ($p<0.002$, T vs F). The CE ratio was 0.4, 1.44, and 0.22 for F, B, and T. When considering only patients with effective diuresis, the CE ratios were 0.18, 1.18, and 0.15.
CONCLUSIONS: B and T had the greatest net urine output, and T induced an effective diuresis in the largest percentage of patients. Torsemide effectiveness may be attributed to the high mean dose utilized during the first 24 hours. Despite higher acquisition cost, T had a similar CE ratio as compared to F due to greater urine output achieved with T. These data suggest that both F and T are cost-effective drugs for the acute treatment of CHF.

19. Reversal of pathologic changes in the pulmonary circulation of hypertensive patients during treatment with angiotensin converting enzyme inhibitors. Alexander A. Cherepok, M.D., *Sergey N. Polyvoda, M.D., D.Sc.*; Zaporozhye State Medical University, Zaporozhye, Ukraine.

PURPOSE: The aim of this study was to study the influence of angiotensin converting enzyme (ACE) inhibitors on the pulmonary circulation and hypertrophy of the right ventricle in hypertensive patients.
METHODS: Fifty-four patients with WHO grade II hypertension (41% female, 59% male) were inspected. Systolic blood pressure was 178.53 ± 12.5 mm Hg, diastolic blood pressure was 96.73 ± 7.2 mm Hg, and prescription of disease an average of 4.6 years. All patients were given official informed consent to participate in research. A group of 19 persons matched for gender and age served as a control. The inspection was carried out using magnetic resonance imaging and Doppler echocardiography, with measurements conducted according to traditional methods. We calculated end diastolic volume, myocardial mass of the right ventricle (RVM), and intramyocardial voltage using a formula we developed and patented. All research was executed at the end of the second week of the placebo period and following 6 months of therapy with the ACE inhibitor enalapril. The mean dose of enalapril was 15.7 ± 3.2 mg/day.
RESULTS: Analysis of the obtained statistics testifies to trustworthy decreasing of end diastolic volume of 13.4%, RVM of 9.6%, and intramyocardial voltage of 16.9% based on systolic and diastolic pulmonary pressure lowering (31.2% and 51.3%, respectively) together with pulmonary wedge pressure decreases of 36.8%. A downward tendency of right ventricular wall thickness was observed; however, it wasn't consistently observed.
CONCLUSIONS: Treatment with ACE inhibitors, enalapril in particular, caused regression of right ventricular hypertrophy and reversal of pathologic changes of pulmonary circulation with hypertension.

20. Underutilization of aspirin in elderly nursing home patients with coronary heart disease. *Marilyn M. Barbour, Pharm.D.*, Kate L. Lapane, Ph.D., Anne Van Haaren, Pharm.D. candidate, Giovanni Gambassi, M.D.; University of Rhode Island, Kingston, RI; Brown University; Universita Cattolica del Sarco Cuore, Rome, Italy.

PURPOSE: To describe the use of aspirin in the management of coronary heart disease (CHD) in frail elderly living in long term care.
METHODS: This was a retrospective cross-sectional survey performed in 45,508 nursing home patients aged at least 65 years with an active admission diagnosis of CHD between 1992 and 1996. Patients were identified using the systematic assessment of geriatric drug use via epidemiology (SAGE) dataset which links minimum data set (MDS) information collected on all nursing home patients in five states (KS, ME, MS, NY, and SD) to a drug utilization file of all medications taken by each patient in the seven days preceding the MDS assessment. Logistic regression identified correlates of aspirin use with odds ratios and 95% confidence intervals reported.
RESULTS: There was a progressive increase in aspirin use from 1992 (13%) to 1996 (18%). Use varied geographically from 11.4% in Kansas to 19.6% in South Dakota. Of aspirin users, 84% were receiving 325 mg/day. Among the 32,938 individuals with HCFA-matched hospitalization records, only 28% with recent myocardial infarction (ICD-9: 410) were receiving aspirin on nursing home admission. While age and race were not associated with aspirin use, women (OR = 0.77; 95% CI: 0.73-0.81) and people cognitively (OR = 0.72; 95% CI: 0.65-0.79) or physically (OR = 0.75; 95% CI: 0.68-0.82) impaired were less likely to receive aspirin.
CONCLUSIONS: Despite the proven benefit of aspirin in patients with CHD, use was limited in our population of elderly nursing home patients. Further study of the risk and benefit of aspirin therapy in this population is needed.

21. Effect of β-adrenergic blockers on congestive heart failure inpatients' average length of stay and mortality during hospitalization. *Laura A. Bartels, Pharm.D.*, Adnan I. Naber M.D.; Albany College of Pharmacy, Albany, NY.

PURPOSE: Long-term evidence suggests β-adrenergic blockers reduce mortality in congestive heart failure (CHF) patients. This study was designed to evaluate β-blockade treatment on mortality during hospitalization and average length of hospital stay (ALOS) in CHF patients.
METHODS: Data were collected by retrospective review from January 1995 to September 1998 for CHF patients who were started on a β-blocker (n=2210, group 1), and CHF patients who did not receive a β-blocker (n=2383, group 2). All β-blockers were included (except ophthalmic preparations). Demographic data including age, race, and gender, in addition to the outcome data of ALOS and percentage expired were collected for both groups. Chi squared analyses were performed on demographic data. Percentage expired and ALOS were evaluated using Z-tests.
RESULTS: Mean ages for groups 1 and 2 were 69.8 years and 67.6 years, respectively. In groups 1 and 2, 52% and 50%, respectively, were male ($p=NS$). Fewer African-American inpatients were in group 1 than group 2 ($p<0.001$). ALOS ranged from 13.7 ± 2.1 to 17.7 ± 2.1 days in group 1 and 10.7 ± 5.1 to 16.6 ± 5.1 days in group 2. ALOS was significantly different between groups in 1996, 1997, and 1998 ($p<0.001$). Percentage expired inpatients ranged from 9.5 to 10.9% in group 1 and 9.1 to 14.3% in group 2, which was significant in 1995 only ($p<0.001$).
CONCLUSIONS: Although there was no significant difference in the percentage expired while hospitalized between groups in 1996-1998, ALOS was increased in CHF inpatients receiving a β-blocker over the same period when compared to non β-blocker patients.

22E. Evaluation of the impact of patient characteristics on the success of carvedilol dose titration. Michele K. Koder, Pharm.D., *Sandra L. Chase, Pharm.D.*, Howard H. Weitz, M.D.; Oregon State University/Oregon Health Sciences University, Portland, OR; Spectrum Health, Grand Rapids, MI; Thomas Jefferson University Hospital, Philadelphia, PA.

Presented at the Eastern States Residency Conference, Baltimore, MD, April 23, 1998.

23E. Evaluation of the impact of providing pharmaceutical care in a Veterans

Affairs cardiology clinic on patients' medication knowledge and adherence assessed by electronic medication event monitoring system. *Vitalina Rozenfeld, Pharm.D.*, Jean-Marie Pflomm, Pharm.D., BCPS, Kulvinder K. Singh, Pharm.D., BCPS, Michelle K. Bazil, Ph.D., Judy W.M. Cheng, Pharm.D., BCPS; Shore Health System, Easton, MD; Bronx Veterans Affairs Medical Center, Bronx, NY; Arnold & Marie Schwartz College of Pharmacy and Health Sciences, Brooklyn, NY.

Presented at the 33rd Annual Midyear Clinical Meeting of the American Society of Health System Pharmacists, December 9, 1998, Las Vegas, NV.

24. Antihypertensive activity of moexypryl: 24-hour arterial pressure monitoring in hypertensive patients. *Sergey N. Polyvoda, M.D., D.Sc.*, Alexander A. Cherepok, M.D.; Zaporozhye State Medical University, Zaporozhye, Ukraine.

PURPOSE: The aim of the given research is to study moexypryl influence on the daily structure of arterial pressure in hypertensive patients.
METHODS: Forty-eight patients with hypertension inspected (42% female, 58% male). The systolic blood pressure (SBP) was 179.7 ± 12.8 mm Hg, and diastolic blood pressure (DBP) was 98.3 ± 8.2 mm Hg. The 24-hour arterial pressure monitoring was carried out using MEDTECH-ABPM2. The research was executed at the end of the second week of the placebo period and after the 12-week period of moexypryl monotherapy. Forty-five percent of patients overtook the preparation in a dose of 7.5 mg/d, while other patients accepted the 2-week therapy of preparation and then the dose was increased in two times.
RESULTS: The analysis of results testifies that moexypryl possesses high antihypertensive activity, authentically reduced ($p<0.05$) SBP and DBP on 5.1% and 6.2% at daytime and 3.9% and 7.1% at night period accordingly. The variability of SBP and DBP was 37.1% and 32.6%, respectively. The value of morning rise SBP and the speed of morning rise SBP was reduced ($p<0.005$) 29.3% and 60.2%, respectively. The same dynamics were observed at DBP - 34.6% and 46.3%, respectively.
CONCLUSION: Using moexypryl decreases the daily average data due to uniform operation at day and night phases of blood pressure daily cycle, authentically decreases the variability of blood pressure, the morning rise of SBP and DBP value and speed, and the characteristic of two-phase rhythm of blood pressure at some categories of patients.

25E. Heart rate response in the early morning hours to chronotherapy and homeostatic therapy in patients with hypertension or in patients with myocardial ischemia. *Stephen P. Glasser, M.D.*, Mary F. Johnson, Ph.D., T. Daniel Fakouhi, Ph.D.; University of South Florida, Tampa, FL; Pharmanet, Boston, MA; GD Searle, Skokie, IL.

Presented at the 13th Annual Meeting of the American Society of Hypertension, New York, NY, May 13-16, 1998.

26. Thromboembolic disease prophylaxis following orthopedic surgery with a warfarin protocol: short- and long-term effectiveness. *William L. Greene, Pharm.D.*; Methodist Healthcare-Central Hospital, Memphis, TN.

PURPOSE: To evaluate the short- and long-term effectiveness of a warfarin protocol for thromboembolism prophylaxis following orthopedic surgery.
METHODS: Patients undergoing major hip or knee surgery at Methodist Healthcare-Central Hospital routinely receive thromboembolic disease prophylaxis with warfarin. A pre-defined dosing protocol for warfarin has been used routinely since November 1996. Data regarding warfarin dosing, international normalized ratio response, and complications were prospectively collected on all patients during their acute care hospitalization for surgery. Performance of the protocol was assessed during two different time periods, November 1, 1996 through January 15, 1997, and January 1, 1998 through April 2, 1998. To assess long-term outcome, a follow-up study involved telephone contact and interview of the first 91 patients on protocol. The interview used standardized questions and focused on the need for hospitalization for any reason in the time following surgery. If the patient indicated that hospitalization was required, or if there was any uncertainty regarding potential complications, hospital records were retrospectively reviewed to determine whether embolic complications had resulted.
RESULTS: The performance of the protocol during inpatient stay, expressed as mean (median; range), was:

	1998 (n=48)	1996 (n=54)
Number patient-days on protocol	5.8 (6; 2-13)	5.0 (5; 2-11)
Number days to reach goal	3.1 (2; 1-7)	2.6 (2; 1-5)
Number days therapeutic	3.9 (4; 1-12)	3.2 (3; 1-10)

Long-term follow up revealed that 4.4% of cases required follow-up treatment for embolic complications within 3 months of discharge.
CONCLUSION: The Methodist Healthcare-Central Hospital warfarin orthopedics protocol provides effective prophylaxis for thromboembolism following orthopedic surgery.

27. Pharmacist-directed coronary artery disease clinic increased the percentage of patients reaching National Cholesterol Education Program LDL-cholesterol goal. *Kjel A. Johnson, Pharm.D.*, Deborah J. Partsch, Pharm.D., Kathleen Taylor, B.S.N., James Rippe, M.D., Kirk Musselman, M.D.; HealthAmerica of Pennsylvania Inc.; University of Pittsburgh, Pittsburgh, PA; Integrated Therapeutics Group; Center for Clinical and Lifestyle Research; Allegheny University Medical Practice.

PURPOSE: To assess the impact of a pharmacist-directed ambulatory coronary artery disease (CAD) clinic on the percentage of patients achieving National Cholesterol Education Program (NCEP) LDL-cholesterol goal.
METHODS: Patients with documented CAD were randomly recruited from nine medical offices. Lipid profiles were drawn at baseline and 14 weeks. A pharmacist counseled treatment subjects regarding medications, nutrition, exercise, and cholesterol results, which were forwarded with pharmacotherapy recommendations to their primary care physicians (PCPs). In addition, a nurse counseled subjects bi-monthly over 14 weeks via telephone regarding exercise and nutritional mailings. Controls received usual care from their PCPs. Changes in LDL-cholesterol and percentage to NCEP goal were assessed at baseline and 14 weeks.
RESULTS: Four hundred twenty-five patients were enrolled; 379 completed the program (198 treatment, 181 control). There were no differences in age (mean 62), gender (71% male), or disease severity between groups. At baseline, 43% of controls were at LDL-cholesterol goal (mean 107 ± 37 mg/dl) versus 31% of treatment subjects (114 ± 38 mg/dl; $p<0.05$). At 14 weeks, 46% of controls were at LDL-cholesterol goal (104 ± 6 mg/dl; $p=0.53$ versus baseline). At 14 weeks, 46% of treatment subjects were at LDL-cholesterol goal (102 ± 31 mg/dl; $p<0.01$), a 47% increase versus baseline. Though the percentage of subjects meeting LDL-cholesterol goal at 14 weeks were not different between groups ($p=0.93$), the reduction in LDL-cholesterol was greater in treatment subjects versus controls (13 ± 32 mg/dl versus 2.8 ± 34 mg/dl, respectively; $p<0.01$).
CONCLUSIONS: A pharmacist-directed CAD clinic decreased LDL-cholesterol and increased the percentage of subjects reaching NCEP goal.

28. The use of carvedilol in an inpatient hospital setting. *Carla A. Luque, Pharm.D.*, Lisette Quintero, Pharm.D. candidate; Nova Southeastern University, Ft. Lauderdale, FL; Mt. Sinai Medical Center, Miami Beach, FL.

PURPOSE: The purpose of this study was to evaluate the usage patterns and safety of carvedilol in a hospital setting.
METHODS: This was a retrospective study of patients who received carvedilol during hospitalization between June 1997 and July 1998. Patient demographics, admission diagnosis, carvedilol dosing schedule, concurrent medications, carvedilol adverse effects, length of stay, and number of readmissions were documented.
RESULTS: Sixty-eight (47 male, 21 female) medical records were reviewed. The mean age was 74 years (43-97). The mean ejection fraction was 26% (10-53%). Thirty-seven of 68 (54%) patients were started on carvedilol in the hospital, whereas the remaining 31 (46%) patients were started on carvedilol prior to admission. Eighteen (49%) patients who had carvedilol started in the hospital and thirteen (42%) who had carvedilol prior to admission had a primary admitting diagnosis which reflected an unstable condition. Thirty (81%) patients were initiated on a starting dose of 3.125 mg twice daily. The most frequent dose of carvedilol on discharge was 6.25 mg twice daily. The majority of the patients were also receiving diuretics, angiotensin converting enzyme inhibitors, and digoxin. Sixteen (24%) of the 68 patients were discharged without carvedilol. Adverse effects included symptoms of worsening heart failure (16), symptomatic bradycardia (6), and vasodilator effects (4). Three patients expired while on carvedilol; cause of death was cardiac arrest.
CONCLUSIONS: Many patients were started on carvedilol despite an admitting diagnosis of CHF exacerbation. The high percentage of medication discontinuation can be attributed to either carvedilol itself or to the patient's unstable condition. As a result, the department of pharmacy will be placing pharmacy communication sheets in the charts of all patients receiving carvedilol in the hospital.

29. Minor alterations in cerivastatin pharmacokinetics by erythromycin and itraconazole. *Arthur Mazzu, Ph.D.*, Evan Stein, M.D., Edward Kelly, Ph.D., Allen H. Heller M.D.; Bayer Corporation, West Haven, CT; Metabolic and Atherosclerosis Research Center, Cincinnati, OH; PPD Pharmaco/RPT Clinic, Morrisville, NC.

Cerivastatin (CER) is a synthetic statin that is uniquely metabolized by cytochrome P450 (CYP) 3A4 and 2C8 concurrently to demethylated (M-1) and hydroxylated (M-23) metabolites. Myopathy has been reported with statin use when coadministered with CYP3A4 inhibitors due to reduced metabolism.
PURPOSE: To determine CER pharmacokinetics when coadministered with erythromycin (ERY) or itraconazole (ITR), both potent CYP3A4 inhibitors.
METHODS: In separate studies, hypercholesterolemic patients were treated to steady state with CER 0.3 mg QD, then treated concurrently for 10 days with ERY 500 mg BID (n=13) or ITR 200 mg QD (n=16). Pharmacokinetic parameters ($AUC_{0\text{-}24}$, C_{max}, and $t_{1/2}$) were measured prior to cotreatment (CER only) and after 10 days (CER + ERY or CER + ITR).
RESULTS: CER pharmacokinetic parameters were modestly increased when administered with ERY or ITR. The $t_{1/2}$ remained at a level which precluded accumulation. Relative to CER alone, CER + ERY and CER + ITR reduced M-1 C_{max} 10-14%, and increased M-23 C_{max} 28-31%, consistent with CYP3A4

inhibition. No myalgia was observed.

Parameters	CER	CER + ERY	CER	CER + ITR
AUC_{0-24} (µg•hr/L)	23.6	35.5 (+ 51%)*	23.8	32.9 (+ 38%)*
C_{max} (µg/L)	3.7	4.6 (+ 24%)	4.8	5.6 (+ 15%)
$t_{1/2}$ (hr)	3.5	4.9 (+ 41%)*	3.4	5.5 (+ 64%)*

*p<0.05 vs CER alone

CONCLUSION: Because CER undergoes metabolism by both CYP3A4 and 2C8, administration of CER 0.3 mg and ERY or ITR yields minor changes in CER plasma levels. ERY or ITR can be administered with CER without concern for accumulation.

30. Use of angiotensin converting enzyme inhibitors in congestive heart failure in a large health care plan population: assessment as validated by chart review. *Rick J. Melbye, Pharm.D.*, Al H. Heaton, Pharm.D.; Prime Therapeutics, Inc., Moorhead, MN.

PURPOSE: The purpose was to determine the utilization and dosage strength of angiotensin converting enzymes (ACE) inhibitors prescribed for congestive heart failure (CHF).
METHODS: Realizing claims from the database can give us the number of patients receiving ACE inhibitors; we also recognize legitimate reasons for not prescribing them, such as contraindications and adverse effects. Because these can only be uncovered via chart review, claims from four regional clinics with ICD-9 codes for CHF (428.0) were identified. The period included qualifying charts from January 1997 through April 1998. We identified those CHF patients on ACE inhibitors. A 10% random sample methodology was used to identify charts for abstraction. We then evaluated their dosage strength to compare with recent American College of Cardiology recommendations.
RESULTS: Sixty CHF charts were pulled. Of these, 34 (57%) showed treatment with an ACE inhibitor, with 5 (8.3%) receiving an adequate dose for this indication. Four patients (6.6%) had contraindications or adverse affects (abnormal renal functions, cough) that prevented ACE inhibitor utilization.
CONCLUSION: Initial evaluation of CHF patient ACE inhibitor utilization indicates underutilization and improper (low) dosage regimens in the groups evaluated. Follow-up studies and education of prescribers is indicated.

31E. Can we safely use abciximab in the elderly with unstable coronary syndromes: how old is too old? *Lynette R. Moser, Pharm.D.*, Mustafa Hashem, M.D., Arshad Ali, M.D., Micheal DeGregorio, M.D., Chandara Narala, M.D., Samir Kazziha, M.D., Theodore L. Schreiber, M.D.; St. John Hospital and Medical Center; Wayne State University, Detroit, MI.

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32E. Clinical benefits of low serum digoxin concentrations in heart failure. Kirkwood F. Adams, Jr., M.D., Mihai Gheorghiade, M.D., Barry F. Uretsky, M.D., *J. Herbert Patterson, Pharm.D.*, Todd A. Schwartz, B.S., James B. Young, M.D.; University of North Carolina at Chapel Hill, Chapel Hill, NC; NC at Cleveland Clinic Foundation, Cleveland, OH

Presented at the meeting of the American College of Cardiology, New Orleans, LA, March 7-10, 1999.

33E. Angiotensin converting enzyme inhibitor use in congestive heart failure: opportunities for pharmacists to improve patient outcomes through the use of evidence-based criteria. *Glen J. Pearson, Pharm.D.*, Charmaine Cooke, B.S., W.K. Trevor Simmons, B.S., Ingrid Sketris, Pharm.D., MPA; Queen Elizabeth Health Sciences Centre; Dalhousie University, Halifax, NS, Canada.

Presented at the Canadian Society of Hospital Pharmacists Professional Practice Conference, Toronto, ON, Canada, February 1-4, 1999.

34. Relationship between leptin and cardiovascular disease in patients with obstructive sleep apnea. *Lora Perkinson*, Bradley G. Phillips, Pharm.D., Masahiko Kato, M.D., Catherine C. Pesek, D.O., Krzysztof Narkiewicz, M.D., Ph.D., Mark E. Dyken, M.D., Virend K. Somers, M.D., Ph.D.; University of Iowa, Iowa City, IA.

PURPOSE: Patients with obstructive sleep apnea (OSA) have an increased risk of cardiovascular morbidity and mortality. Leptin is a humoral factor which regulates body weight and affects the cardiovascular system. We evaluated the relationship between leptin and 1) family history of cardiovascular disease, and 2) mean arterial pressure (MAP) and heart rate (HR) in patients with untreated OSA.
METHODS: We prospectively studied 64 male patients (age 52 ± 2 years) with OSA documented by complete overnight polysomnography. Family history of cardiovascular disease was documented; supine MAP and HR were determined. Plasma leptin concentrations were determined by RIA.
RESULTS: Of the 64 patients studied, 80% (n=51) had a positive family history of cardiovascular disease. Patients with and without a family history of cardiovascular disease were matched for age and body mass index. Leptin in patients with a positive family history of cardiovascular disease was 20 ± 2 pg/ml compared to 23 ± 4 pg/ml (p=NS) in those with a negative family history. Leptin did not correlate with MAP and showed a positive relationship with supine resting HR (r=0.36, p=0.007).
CONCLUSION: A family history of cardiovascular disease is common in patients with OSA. Leptin levels are similar in OSA regardless of family history and may regulate, in part, resting HR. These findings implicate that leptin affects the cardiovascular system but it does not appear to be linked to a family history of cardiovascular disease.

35E. The effects of short-term passive smoke exposure on endothelium-dependent and independent vasodilation. Masahiko Kato, M.D., Philip Roberts-Thomson, M.D., Ph.D., William G. Haynes, M.D., *Bradley G. Phillips, Pharm.D.*, Virend K. Somers, M.D., Ph.D.; University of Iowa, Iowa City, IA.

Presented at the 48th Annual Scientific Session of the American College of Cardiology, New Orleans, LA, March 7-10, 1999.

36. Development and validation of a heparin titration nomogram in heart failure patients admitted to a university hospital. *Deb S. Sherman, Pharm.D.*, Susan H. Clarke, M.T., Rob Valuck, Ph.D., Kam Capoccia, B.S., JoAnn Lindenfeld, M.D., Kathleen A. Stringer, Pharm.D., FCCP; University Hospital; University of Colorado Health Sciences Center, Denver, CO.

PURPOSE: Consensus is lacking regarding the process for developing and validating a heparin titration nomogram. It has been suggested that in vitro heparin/aPTT values may not correlate to in vivo heparin/aPTT values. Therefore, this study was designed to develop a heparin titration nomogram and to determine the utility of validation using in vitro and in vivo heparin/aPTT data.
METHODS: A heparin titration nomogram was constructed by diluting heparin in normal pooled plasma to achieve final heparin concentrations as measured by chromogenic anti-Xa assay. The corresponding aPTT was determined for each sample. Linear regression was performed to determine the correlation between aPTTs and heparin levels. The nomogram was derived using 0.2-0.4 U/ml as the therapeutic heparin range.

Heparin (U/ml)	aPTT (sec)	Bolus Dose	Hold Infusion	Rate Change
< 0.14	< 39	50 U/kg	0	+ 3 ml/hr
0.14-0.19	39-44	0	0	+ 3 ml/hr
0.2-0.4	45-72	0	0	none
0.41-0.47	73-89	0	0	- 2 ml/hr
0.48-0.65	90-129	0	30 min	- 3 ml/hr
> 0.65	0	0	60 min	- 4 ml/hr

Heart failure patients determined by their physician to need anticoagulation with intravenous unfractionated heparin were eligible for the study. Heparin was initiated with a 50 U/kg bolus and 15 U/kg/hr infusion and adjusted based on the nomogram. Heparin concentrations were determined from blood samples obtained for aPTTs. Linear regression with Pearson's correlation was performed to determine the correlation between in vitro and in vivo heparin/aPTT values.
RESULTS: One hundred fourteen heparin/aPTTs were obtained. Linear regression determined a significant correlation between in vitro and in vivo heparin/aPTT values (r=0.75, p=<0.0001).
CONCLUSIONS: The use of in vitro and in vivo heparin/aPTT values resulted in validation of the heparin titration nomogram. This method, however, may not be globally applicable across institutions due to variability in methods and aPTT assays. Individual institutions need to assess this methodology to develop an institution specific heparin titration nomogram.

37. Effect of age on angiotensin converting enzyme inhibitor utilization in heart failure. Jill K. Leslie, Pharm.D. candidate, Julie M. Koehler, Pharm.D., *Kevin M. Sowinski, Pharm.D.*; Purdue University; Butler University; Clarian Health Partners, Inc., Indianapolis, IN.

PURPOSE: Numerous studies show that angiotensin converting enzyme (ACE) inhibitors reduce morbidity and mortality in patients with heart failure and that these agents are underutilized and underdosed in these patients. Limited data regarding the effect of age on ACE inhibitor utilization are available. The purpose of this study was to investigate the effect of age on ACE inhibitor utilization in heart failure.
METHODS: Three hundred twenty-five patients discharged from a university-based hospital with heart failure (ICD-9 428) between January 1, 1994 and December 31, 1996 were included. Patients were categorized into two age groups: young (n=164; less than 64 years of age) and elderly (n=161; at least 65 years of age). Admission and discharge data (patient demographics, ACE inhibitor and other drug use) were obtained retrospectively from computerized and written medical records. All ACE inhibitor doses were normalized to enalapril equivalent doses (e.g., enalapril 20 mg/day = captopril 150 mg/day = enalapril equivalent dose [EED] = 1). In addition, ACE inhibitor doses were adjusted for renal function, assuming a 50% decrease in maintenance dose in individuals with CrCl less than 30 ml/min or SCr greater than 3.0 mg/dl as suggested in the AHCPR heart failure guidelines. Statistical comparisons in ACE inhibitor utilization patterns between young and elderly were made with the chi squared test.
RESULTS: Data presented as patient numbers (percentages) are listed. No

statistical differences were observed between the young and elderly groups.

	No ACE Inhibitor		EED < 1		EED ≥ 1	
	Young	Elderly	Young	Elderly	Young	Elderly
Admission	93 (56.7%)	104 (64.6%)	54 (32.9%)	42 (26.1%)	17 (10.4%)	15 (9.3%)
Discharge	64 (39.0%)	75 (46.6%)	74 (46.0%)	57 (35.4%)	26 (15.9%)	29 (18.0%)

CONCLUSIONS: No age-related differences in ACE inhibitor utilization were observed. ACE inhibitors are underutilized in patients with heart failure. Doses of ACE inhibitors shown to reduce mortality are utilized in a small percentage of patients diagnosed with heart failure.

38. Preventive therapy in case of angina pectoris: a trigger for pharmaceutical care. *M.G. van der Bent*, M.A.H.M. Fluitman, K.W. van der West, S.E. Talbot; University of Utrecht; Bohemenwijk Apotheck, The Netherlands.

To apply pharmaceutical care in community practice, a good collaboration and communication between the pharmacist and general practitioner (GP) is essential. This study demonstrates that pharmacists then have the possibility of performing such a task on a routine basis. A computerized medication recording system and electronic connections between pharmacists and GP favor this process. The patient benefits from this performance in terms of quality of care. In 1996, the treatment standards of the DGPA adopted platelet aggregation inhibition therapy (PAIT) as an additional preventive therapy for cardiovascular accidents in angina pectoris (AP) patients. The treatment consists of aspirin (ASA) 80 mg 1 dose daily.
PURPOSE: To monitor if patients who can be recognized as being AP patients are indeed receiving this preventive therapy. The pharmacists could play a role to alert the doctor and/or patient if PAIT is omitted.
METHODS: First, the part of the pharmacy population with a (probable) diagnosis of AP should be identified. This can be realized by analyzing those patients with a history of nitrate (long- or short-acting) in their medication profile. This selection reveals patients which have (suspected) AP complaints as well as patients with cardiac failure. To subselect only those patients with AP, the patients should be interviewed, or the family doctor could confirm the diagnosis of AP. The medication profile of this subselection shows if they are treated according to the standard. If not, the pharmacists could alert the doctor to adjust the medication. Preliminary results for 17,886 patients include:

Year	A (n, %)	B (n, %)	C (n, %)
1996	269 (1.6)	194 (72.1)	135 (69.6)
1997	286 (1.7)	207 (72.4)	144 (69.6)
1998	291 (1.8)	216 (74.2)	154 (71.3)

A = patients on long- and short-acting nitrates; B = patients on nitrates with confirmed diagnosis of AP; C = patients from group B with PAIT

The results show no clear changes in the percentage of AP patients treated with ASA over time. It reveals that about 70% of the selected patients group was treated according to the AP standard of the DGPA.
CONCLUSION: Many studies have shown that ASA on a daily basis reduces the number of thrombotic events by approximately one-third. For that reason, ASA preventive therapy should be started in all AP patients unless there are specific contraindications for use. This principle was adopted in the AP standard of the DGPA in 1996. This study shows no increase in the percentage of ASA-treated patients within the AP population over the years 1996-1998. It appears that only about 70% of all patients received ASA as preventive therapy. It would be interesting to investigate the reason for nontreatment of the additional 30%. Are there specific contraindications such as allergies? Are many patients in this group on anticoagulant therapy or does their GP simply not follow the standard for AP treatment? Communicating these results to the various GPs could contribute to a further elucidation of this question. Where indicated, the therapy can be adjusted. By supporting the GP with this type of analysis, the pharmacist can contribute to optimal patient care. An integrated and proactive approach of both GPs and pharmacists combined with clear treatment guidelines could protect patients for unnecessary harm.

39. Utilization of lipid lowering drugs used in Hong Kong hospital specialist clinics. *William C.F. Wong, M.S.*, Brian Tombuson, M.B.B.S., M.D.; Tai Po Hospital; Prince of Wales Hospital, Hong Kong.

PURPOSE: This study was conducted to review the utilization pattern of lipid lowering drugs (LLDs) in different specialist medical clinics in a Hong Kong teaching hospital. It examined adherence to lipid guidelines for commencement of treatment, achievement of appropriate target goals, and the relative cost-effectiveness of LLDs.
METHODS: Patients receiving LLDs were identified from prescriptions during a 4-week period in January 1997. Their case records were subsequently reviewed to determine the category of cardiovascular risk, lipid levels prior to treatment, and response to medication. Patients were stratified into three risk groups: 1) those with known atheromatous disease, 2) those with other risk factors, and 3) those without other risk factors.
RESULTS: The study included 461 patients. Simvastatin and lovastatin were the most commonly prescribed LLDs (33% and 30%, respectively, of all prescriptions), especially in the cardiac and hypertension clinics, followed by gemfibrozil (20% of total) which was used mainly in the diabetes and general medical clinics. Treatment was initiated when LDL-cholesterol levels were below those recommended by the British Hyperlipidemia Association in 17% of patients in risk group 1 and 59% in risk group 2. Achievement of target LDL-cholesterol levels in the short-term varied from 20-71% with different drugs. The most cost-effective drug dosage was simvastatin 5 mg for cost per unit (in both percentage and mM/L) reduction in LDL-cholesterol.
CONCLUSION: We conclude that the adherence to guideline levels for initiation of treatment and achievement of goal levels in these clinics do not correspond well with established recommendations.

Critical Care

40. Adverse drug reactions in patients after cardiac surgery: a prospective study. *Guillermo Gonzalez-Martin, Pharm.D.*, Claudia Soto, Trinidad Hoyl, M.D.; Catholic University of Chile, Santiago, Chile.

PURPOSE: To determine the frequency, characteristics, and predisposing factors to adverse drug reactions (ADR) in hospitalized patients after cardiac surgery.
METHODS: The design was a prospective, observational study of hospitalized patients in the clinic of the Catholic University of Chile. A clinical pharmacist gathered the following data: patients' clinical characteristics, concurrent illnesses and medications, relevant laboratory data, and previous drug consumption. When an adverse event (AE), suspected of being induced by a drug, was observed, the physician, the investigator, and a clinical pharmacologist assessed the causality and the severity of the AE. The causality was evaluated using an algorithm in which reactions were categorized as definite, probable, or possible.
RESULTS: Sixty-two patients (44.9%) developed one or more RAM during their stay in the hospital. These patients developed 104 AEs induced by drugs. The cardiovascular (40.4%) and metabolic systems (40.4%) were the organ systems most affected by ADR. Arterial hypotension induced by propranolol and captopril (38.1%) , bradycardia induced by propranolol (14.3%), and A-V blockade by amiodarone (11.9%) were the ADR that most frequently affected the cardiovascular system. Hypokalemia induced by furosemide was the most frequent ADR that effected the metabolic system. Patients over 60 years of age developed associated ADR to furosemide and propranolol, while amiodarone was the drug responsible for ADR in patients under 60 years. Of the RAM, 96.1% were classified as probable, 85.6% started acutely, and 59.6% had a duration of one day or less. Of the ADR, 21.2% were classified as severe. Of the ADR, 31.7% were followed by a therapeutic modification, discontinuation (39.4%), or replacement of the treatment (31.7%); 62.5% of the ADR prolonged the length of hospitalization. The patients with valvulopathies had a high tendency to develop ADR. There were no statistically significant differences found in the frequency of the ADR when age, gender, previous history of ADR, or previous hypersensitivity drug reactions of the patients were compared.

41. Effect of lactic acidosis on blood volume and systemic and regional blood flow in pigs. Hong Zhao, Ph.D., *Moses S.S. Chow, Pharm.D.*; University of Connecticut; Hartford Hospital; The Chinese University of Hong Kong, Shatin, Hong Kong.

PURPOSE: To determine the effect of acute systemic acidosis on blood volume, total cardiac output, and regional blood flow.
METHODS: Systemic acidosis was induced in 6 of 12 anesthetized pigs by infusion of 0.3 M lactic acid and maintained at an arterial pH 7.05-7.25. Similar volume of normal saline was infused to the other six pigs. Blood volume was determined by the carbon monoxide technique. Total cardiac output (CO) was determined by thermodilution technique. Blood flow to brain (B), heart (H), liver (L), kidney (K), muscle (M), slow equilibrating tissues (SET) such as skin and bone, and portal-mesenteric region (PM) were determined by colored microsphere technique. In addition, the hepatic arterial (HA) and venous (HV) and portal venous (PV) flows were determined by perivascular ultrasonic flow probes positioned at the respective vessels. All animals also received the same dose of lidocaine infusion as part of a separate kinetic study.
RESULTS: The CO and flow values (L/min) for major organs and hepatic vessels in the acidosis vs control groups were:

	CO	B	H	L	K	M	HA	HV	PV
Acidosis	2.76 ± 0.62	0.03 ± 0.01	0.10 ± 0.02	0.51 ± 0.09	0.19 ± 0.04	0.69 ± 0.19	0.14 ± 0.02	0.53 ± 0.07	0.40 ± 0.08
Control	2.57 ± 0.40	0.03 ± 0.01	0.11 ± 0.02	0.62 ± 0.09	0.22 ± 0.13	0.44 ± 0.18	0.15 ± 0.01	0.63 ± 0.10	0.49 ± 0.11

No statistically significant differences were observed in any of these major organ and hepatic vessel flows. Furthermore, no significant differences were found in SET and PM flows. The blood volumes in the acidosis and control groups were 75 ± 11 and 68 ± 14 ml/kg, respectively (p=NS).
CONCLUSION: Systemic acute lactic acidosis at pH range 7.05-7.25 causes insignificant changes in blood volume, cardiac output, and regional blood flow in this animal model.

42E. Alterations in intestinal carrier-mediated transport following thermal injury in rats and the potential role of luminal cytokines. *Brien L. Neudeck, Pharm.D.*, Richard D. Klein, Jeffrey P. Gonzales, Stewart C. Wang, Lynda S. Welage; University of Michigan; Ann Arbor, MI.

Presented at the Society of Critical Care Medicine 28th Educational & Scientific Symposium, San Francisco, CA, January 1999.

43. Effectiveness of urinary dipsticks to screen bacteriuria in ICU patients. Edgar Tisso, Christian Cornette, Ph.D., Pharm.D., *Marie-Christine Woronoff-Lemsi, Ph.D., Pharm.D.*, Patrick Plesiat, Ph.D., Pharm.D., Micheline Jacquet, Pharm.D., Gilles Capellier, Ph.D., M.D.; Besançon University Hospital, Besançon Cedex, France.

PURPOSE: The aim of this prospective clinical study is to evaluate the effectiveness of urinary dipsticks using Multistix 8SG® (Bayer Diagnostic™) to screen asymptomatic bacteriuria in catheterized intensive care unit (ICU) patients.
METHODS: Each urine specimen quantitatively cultured was concurrently tested at the bedside with a dipstick (leukocyte esterase and nitrate reductase activities), analyzed with Clinitek 50® (Bayer Diagnostic™). Significant bacteriuria was defined as a colony count of $\geq 10^5$ CFU/ml, with no more than two species of organisms. Sensitivity (Se), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV) of four categories were assessed: leukocyte and nitrite (L+ and N+), leukocyte or nitrite (L+ or N+), leukocyte (L+), and nitrite (N+).
RESULTS: During 4 months, 199 urine specimens concerning 87 patients were tested.

	Se (%)	Sp (%)	PPV (%)	NPV (%)
L+ and N+	51.6	95.2	66.6	91.4
L+ or N+	83.9	63.7	29.9	95.5
L+	83.9	73.4	36.6	96.1
N+	53.3	84.5	38.1	90.4

The incidence of asymptomatic bacteriuria was 32.2%. The four most frequently isolated pathogens were *Escherichia coli* (32%), *Enterococcus sp.* (26%), *Candida sp.* (12%), and coagulase-negative staphylococcus (9%).
CONCLUSIONS: Urinary dipsticks can be routinely proposed to screen asymptomatic bacteriuria in catheterized ICU patients (NPV = 96.1%) and could decrease the cost of nosocomial urinary infection diagnostics.

44. A prospective evaluation of empiric vs protocol-based continuous sedation in critically ill patients. Johanna M. Plamondon, B.S., Kirk B. Ramsay, B.S., *Robert MacLaren, Pharm.D.*, Graeme M. Rocker, M.A., D.M., FRCP, FRCPC, Richard I. Hall, M.D., FRCPC, FCCP; Queen Elizabeth II Health Sciences Centre, Halifax, NS, Canada.

PURPOSE: To compare empiric continuous sedation (ES) to protocol-based continuous sedation (PS) in terms of mechanical ventilation, length of intensive care unit (ICU) stay, hourly acquisition cost of sedative medications (ACS/hour), and the presence of irritation/agitation or pain.
METHODS: Seventy-two ES patients and 86 PS patients requiring sedation for at least 6 hours were prospectively studied for 4 months before (ES) and after (PS) an evidence-based sedation protocol was implemented over 2 weeks in the medical/surgical/neurologic ICU. The protocol promotes the use of midazolam or propofol by continuous infusion for short-term sedation (less than 48 hours) but advocates the use of lorazepam by scheduled intermittent dosing or continuous infusion for long-term sedation (at least 48 hours). Comparisons between ES and PS included patient demographics, ICU admission criteria, hours of mechanical ventilation, hours of ICU stay, hours of sedation, hours between sedation discontinuation and tracheal extubation, hours between sedation discontinuation and ICU discharge, ACS/hour, and the fractions of hourly assessments completed by the bedside nurse that indicated the presence of irritation/agitation or pain (defined as a modified Ramsay score of 1 and a modified visual analogue pain scale score at least 2, respectively). Post-hoc analyses compared ES and PS patients according to duration of sedation (short-term and long-term). Statistical analyses included Mann-Whitney U tests for continuous data and chi squared tests for dichotomous data.
RESULTS: Demographic data, ICU admission criteria, APACHE II scores, hours of mechanical ventilation, hours of ICU stay, hours between sedation discontinuation and extubation, and hours between sedation discontinuation and ICU discharge were similar between PS and ES for all analyses. Sixty (83.3%) and 69 (80.2%) ES and PS patients were initially sedated with propofol, respectively. The duration of sedation tended to be longer with PS (122.7 ± 142.8 hours vs 88 ± 94.8 hours, p=0.08) but ACS/hour was lower with PS ($5.51 ± 4.27 $hour^{-1}$ vs $7.44 ± 5.21 $hour^{-1}$, p=0.011). PS patients experienced less irritation/agitation (11% vs 22.4 %, p=0.013) and pain (5.9% vs 9.6%, p=0.04). Forty (55.6%) and fifty-seven (66.3%) ES and PS patients received long-term sedation, respectively. Post-hoc analyses demonstrated that PS reduced ACS/hour ($4.81 ± 3.37 $hour^{-1}$ vs $7.32 ± 4.27 $hour^{-1}$, p=0.002), agitation/irritation (11.1% vs 24.8 %, p=0.0004), and pain (5.3% vs 10.3%, p=0.03) for long-term sedation only.
CONCLUSION: Implementation of an evidence-based PS may not influence short-term sedation therapy but reduces medication costs and patient discomfort associated with long-term sedation without adversely affecting mechanical ventilation or duration of ICU stay.

45. Stress ulcer prophylaxis in trauma patients. *Brian L. Erstad, Pharm.D.*, Jeffrey F. Barletta, Pharm.D., John Fortune, M.D.; Arizona Health Sciences Center, Tucson, AZ.

PURPOSE: Given the lack of consensus on virtually every aspect of stress ulcer prophylaxis, a survey was developed to assess current prescribing practices in level I trauma centers in the U.S. In addition, the survey had questions concerning intra-institutional evaluations of prescribing practices.
METHODS: A survey was developed that contained questions related to institutional prescribing and evaluation of stress ulcer prophylaxis. The survey was intended to delineate these practices at the 188 level I trauma centers (at the time of this survey) in the U.S. The survey was limited to the front and back of one sheet of paper to encourage completion. The survey had 11 questions concerning stress ulcer prophylaxis, although there were subparts to several of the questions.
RESULTS: One hundred eighteen surveys were returned from level I trauma centers yielding a total response rate of 63%. Eighty-six percent of level I trauma centers stated that medications for stress ulcer prophylaxis are used in a vast majority (more than 90%) of trauma patients admitted to the intensive care unit. Sixty-five percent of institutions stated that there is one preferred medication for stress ulcer prophylaxis. For these institutions, H_2-blockers were the most popular at 71%. Sucralfate was the agent of choice for 25%, while omeprazole and antacids were preferred for 3% and 1%, respectively.
CONCLUSIONS: Stress ulcer prophylaxis is used in the vast majority of patients admitted to trauma intensive care units in the U.S. While H_2-blockers are most commonly used for prophylaxis, sucralfate is the agent of choice in a substantial number of trauma centers.

46. Dosage of vancomycin in polytrauma critically ill patients. *Dolors Soy*, Francesc Sorio, Esperanza Montes, Nora Izco, Nuria Corominas, Josep Ribas; Hospital Clínic de Barcelona, Barcelona, Spain.

PURPOSE: To evaluate vancomycin dosage and posology in polytrauma intensive care unit (ICU) critically ill patients.
METHODS: This study included ICU patients who had received vancomycin for treatment or prophylaxis of gram positive coccal infections. They were included in two groups: group A with 30 patients with polytrauma (PLT) and group B with 24 critically ill patients with other diseases (NPLT). For each patient, the daily dose, schedule, weight, and serum creatinine were reported. Two blood samples were obtained at steady state, one just before the dose and another 3 hours later, and quantified by enzymoimmunoassay. Vancomycin monitoring was done, using a 2-compartment Bayesian approach, the PKS Pharmacokinetic System (Abbott). Dose and posology were adjusted to reach trough and peak target concentrations of 5-10 µg/ml and 20-40 µg/ml, respectively. SPSS v.613 was used for statistical analysis. Data are reported as mean ± SD. A p-value of less than 0.05 was considered significant for all comparisons.
RESULTS: There were no significant difference between the two groups in weight (68.2 ± 9.8 kg vs 70.8 ± 11.7 kg; p=0.38) and serum creatinine (0.80 ± 0.15 mg/dl vs 0.88 ± 0.16 mg/dl; p=0.07). Mean age was significantly different (41.9 ± 23.2 years vs 57.4 ± 17.4 years; p=0.009). Thus, patients were divided in two groups: more than 60 and less than 60 years old. In patients younger than 60, there were no differences in weight, mean age, and creatinine, between PLT (n=22) and NPLT patients (n=10), but there was in dosage. PLT patients younger than 60 years received higher doses (44.7 ± 7.7 mg/kg/day vs 24.2 ± 8.7 mg/kg/day; p=0.0001) than NPLT patients. In patients older than 60 years, no differences were found in weight, mean age, creatinine, and dosage (24.1 ± 9.0 mg/kg/day vs 20.5 ± 6.1 mg/kg/day; p=0.28).
CONCLUSIONS: In our study, it seems that polytrauma ICU patients younger than 60 years needed higher doses of vancomycin than older patients, usually 45 mg/kg/day or 15 mg/kg/8h.

Dermatology

47. A noninvasive method of assessing the efficacy of counterirritants in humans. K.R. Kulkarni, B.Pharm., *M.N. Saraf, Ph.D.*; Bombay College of Pharmacy, Mumbai, India.

PURPOSE: Methylsalicylate, menthol, and camphor are known to possess counterirritant properties and are used therapeutically as pain-relieving ointments. The powerful sensory irritation produced by the application of counterirritants on the skin causes an increase in skin blood flow (SBF). The purpose of the investigation was to evaluate the dose-related effects of these agents on SBF using the technique of laser Doppler flowmetry.
METHOD: The method briefly involved the measurement of SBF on 12 forehead skin sites of six volunteers after the application of each ointment formulation of the counterirritants in concentrations of 5%, 10%, and 20% using a laser Doppler flowmeter for an hour. The parameters (area under the curve, peak rise in SBF, and time to achieve peak rise in SBF) were derived using Perisoft software.
RESULTS: The AUC and the peak rise in SBF of methylsalicylate

formulations was significantly greater than for menthol or camphor. The parameters of AUC and peak rise in SBF allowed the magnitude and the extent of rise in SBF following topical application of counterirritants to be gauged in a straightforward and objective fashion.
CONCLUSION: Methylsalicylate, menthol, and camphor produce dose-related increases in SBF in human volunteers, the efficacy of methylsalicylate being the highest. This noninvasive, reproducible, and sensitive technique of laser Doppler flowmetry does offer an objective measurement of the efficacy of counterirritants that can appeal to clinical research laboratories engaged in skin testing of drugs.

48. Quality and selection of medical latex gloves: evolution of latex protein levels from 1995 to 1998. *Blandine Lehmann*, Pierre-Yves Chambrin, Beatrice Miquel, Jeanine Auchere, Annick Tibi, Domique Pradeau; Pharmacie Centrale des Hôpitaux, Paris, France.

PURPOSE: Latex allergy is a real problem for health care workers in hospitals. In order to compare, select, and purchase latex gloves for Parisian hospitals, several tests have been performed by our laboratory. With respect to latex protein levels often correlated to hypersensitivity reactions, we measured the total latex protein levels of marketed gloves over a period of three years.
METHODS: We performed the extractable latex protein quantitation following international (ISO WD 12 243 [United Kingdom]) in 1995, and European standards (Pr EN 455.3) from September 1996. This method is based on a double glove extraction (by water, TRIS, or TES buffer for 1-3 hours) under moderate agitation followed by precipitation of proteins and dosage by modified Lowry. Several types of latex medical gloves (60 references) from numerous manufacturers were examined: surgical gloves, examination gloves, powdered gloves, or nonpowdered gloves.
RESULTS:

	1995	1996	1998
Percentage of gloves over 200 µg of total proteins/g of glove	63	0	0
Percentage of gloves over 50 µg of total proteins/g of glove	81	67	23
Mean of extractable latex proteins level (µg/g)	295	-	-
Percentage lower than 50 µg of total proteins/g of glove	0	33	77

CONCLUSIONS: This study has shown a significant decrease of the total latex protein of medical gloves available on the market over three years. This observation could be explained by the concern of latex suppliers and glove manufacturers regarding the quality of latex devices. In fact, in 1998, most manufacturing processes achieve levels of extractable protein residues below 50 µg/g. As a result, the selection of gloves with low extractable protein levels is facilitated. A benefit in term of reduced latex exposure of health care workers could be expected. In fact, the reduction of the hazards posed by latex in medical environment could led to lower sensitization of hospital personnel. To date, it is still not possible to define an extractable protein level that can be defined as nonsensitizing and safe.

Drug Delivery

49. Stability of meperidine in an implantable infusion pump at 37°C. Susan C. Harvey, M.D., Charles P. Toussaint, Sharon E. Coe, B.S., Erin E. Watson, B.S., Michael G. O'Neil, Pharm.D., *Kennerly S. Patrick, Ph.D., FCP*; Medical University of South Carolina, Charleston, SC.

PURPOSE: To determine if a drug stability problem exists in the novel use of meperidine in a surgically implantable continuous infusion pump. Morphine has customarily been used in this devise. A recent report extends the use of this long-term delivery pump to meperidine in a patient who could not tolerate morphine. However, the stability of aqueous meperidine HCl at body temperature over a prolonged period, and while exposed to the potentially reactive interior of the pump, has not been established. Hydrolytic stability is of special concern with meperidine because it is an ester.
METHODS: A new capillary gas chromatographic-mass spectrometric method was developed for the analysis of meperidine using 3,3,5,5-($^2H_4$)-meperidine as an internal standard. Chromatography was performed on a (5% phenyl) methylpolysiloxane column (30 m x 0.32 mm I.D., 0.25: film thickness) operated at 195°C; helium carrier gas-50 cm/s, t_R = 2.3 min. Ionization was by electron impact and detection was by selected ion monitoring of the molecular ions.
RESULTS: The analytical method provided high response linearity (mean r=0.9982) and precision (< 6.5% CV). Application to the stability of aqueous meperidine HCl (10 mg/ml) in the infusion pump maintained at 37°C for 90 days revealed no demonstrable drug degradation.
CONCLUSIONS: Meperidine in a surgically implantable continuous infusion pump (for delivery to an intrathecal or epidural site) appears to be a viable analgesic option for long-term dosing in patients who cannot tolerate morphine. This delivery route also obviates first-pass metabolism to neurotoxic normeperidine.

50. Stability of ceftazidime in PVC bags and continuous infusion. *Catherine L'Eilde, P.D.*, Gilles Piriou, P.D., Emmanuelle Bernoud, P.D., Christophe Pitre, P.D., Didier Tande, P.D., Christian Berthou, M.D., Nicole Borgnis Desbordes; Brest University Hospital, Brest, France.

PURPOSE: Continuous infusion of β-lactams (e.g., ceftazidime) is a means of optimizing antimicrobial therapy by maintaining serum concentration greater than the minimum inhibitory concentration. One practical problem which has to be considered is the drug's stability during the administration.
METHODS: The stability of ceftazidime 6 mg/ml in dextrose 5% injection (D5W) solution in PVC bags was studied when these solutions were stored frozen at -20°C for 30 days, and thawed by microwave radiation. Ceftazidime concentration was determined by HPLC at time zero, and days 1, 3, 7, 14, and 30. Additional assays were performed on admixtures subjected to microwave thawing after storage at -20°C for 30 days, and after subsequent storage at room temperature (20°C) for 24 hours. All solutions were observed for color change and precipitation. pH was tested and UV spectrum analysis was performed at each time interval. Antimicrobial assay was also used by a microbiological agar diffusion technique. Leaching of the plasticizer di-ethyl hexylphtalate (DEHP) was measured by HPLC on day 30 followed by 24 hours at 20°C.
RESULTS: No pH, visible changes, or UV spectra changes were observed. No peak for degradation product appeared on the chromatograms. No DEHP concentrations above 1 ppm were detected. Mean ceftazidime concentration remained above 90% of the initial concentration with both techniques.
CONCLUSION: Ceftazidime 6 mg/ml in D5W is stable when stored in PVC bags for up to 30 days at -20°C, thawed by microwave radiation, and followed by up to 24 hours at 20°C. These results allow for continuous infusion of such solutions of ceftazidime.

51. Stability of intravenous citalopram hydrochloride in either polyvinyl chloride bags or glass containers for infusion therapy, and compatibility with dipotassium clorazepate admixed. *Charles Gury, M.D., Pharm.D.*, Isabelle Dolizy, Pharm.D., Nicole Aymard, Ph.D., Yassine Sellali, Pharm.D.; Sainte-Anne Hospital, Paris, France.

Citalopram (CTP) is the first selective serotonin inhibitor antidepressant utilizable by infusion. The stability and compatibility of CTP hydrochloride in common IV fluids and in the presence of dipotassium clorazepate (DCZ) were studied. One ampule of CTP (40 mg/ml) was added to 250 ml of 5% (D5W) dextrose and 0.9% sodium chloride (NaCl 0.9%) injection in polyvinyl chloride (PVC) bags or glass containers stored at room temperature (22°C) and exposed to daylight for 24 hours. All that were solutions were prepared in triplicate and were observed visually at intervals up to 24 hours. pH was measured and samples were tested for CTP concentration by high-performance liquid chromatography. After that, each CTL solution was admixed with dipotassium clorazepate 20 mg/2 ml. Each drug combination was prepared in triplicate and the same procedure was followed. The remaining concentrations of CTP, expressed in a percentage of the initial concentration (CV), are shown below. The same data were collected for DCZ (expressed as nordazepam).

Time	NaCl 0.9% PVC bags + CTP	D5W PVC bags + CTP	NaCl 0.9% PVC bags + CTP + CZP	D5W PVC bags + CTP + DCZ	NaCl 0.9% Glass contains + CTP
T_0	100 (4.1)	100 (2.6)	100 (0.6)	100 (1.0)	100 (0.2)
T_{1h}	104 (0.8)	100 (0.5)	98 (2.4)	96 (1.0)	106 (1.4)
T_{2h}	97 (1.8)	97 (0.9)	99 (0.9)	97 (0.6)	99 (0.2)
T_{4h}	101 (1.4)	99 (1.5)	100 (1.3)	97 (0.6)	103 (0.8)
T_{6h}	101 (0.8)	100 (0.25)	103 (5.0)	98 (1.4)	96 (0.4)
T_{24h}	101 (1.2)	96 (0.65)	98 (2.2)	94 (1.9)	98 (0.8)

CTP was stable in and compatible with the IV solutions tested in PVC bags and glass containers, and in the presence of the secondary drug (DCZ) throughout the study period. CTP remained at least 94% of initial concentration and there were no visual phenomena nor change in pH indicating incompatibility. CTP was stable only during the first 4 hours in the presence of CTP. Then, clorazepate was hydrolyzed in an active compound, nordazepam, faster than without CTP. CTP can be used alone in perfusion diluted with NaCl 0.9% or D5W in PVC bags or glass containers, at room temperature and exposed to daylight, during several hours (maximum 24 hours). When an anxiolytic is needed, only CTP can be admixed and the infusion must not exceed 4 hours.

Education

52. Publication rates of U.S. schools and colleges of pharmacy: a 22-year history. Dennis F. Thompson, Pharm.D., *Monica L. Mathys, Pharm.D.*; Southwestern Oklahoma State University, Weatherford, OK.

PURPOSE: To provide a 5-year update, 1993 to 1997, on previously published data (*Pharmacotherapy* 1995;15:487-494).
METHODS: Data were obtained from the Science Citation Index (SCI) geographic listings section. The SCI database covers the top 4500 journals in

the technical and scientific fields. Citations were counted without regard to publication type (i.e., letter, abstract, review). Duplicative publications were eliminated. Faculty counts for the inclusive years were obtained from the Roster of Faculty and Staff of the American Association of Colleges of Pharmacy.
RESULTS: Total publication output seems to have reached a plateau for the 1990s. Approximately 13 (17%) schools and colleges of pharmacy (SCOP) account for half the publications during this period. Medical center-based SCOP continue to be more productive than nonmedical center-based SCOP ($p<0.01$), as do public over private SCOP ($p<0.01$). Half the SCOP continue to be minimally productive, producing less than 20 publications per year, or 0.5 publications per faculty per year.
CONCLUSIONS: A small group of SCOP produce the majority of publications. Half the SCOP are minimally productive. Total publications by SCOP appear to have reached a plateau during the 1990s.

53. Formal instruction on prescription writing and its jurisprudence: a survey of all U.S. osteopathic and allopathic medical schools. *Larry W. Segars, Pharm.D., BCPS*; The University of Health Sciences College of Osteopathic Medicine, Kansas City, MO.

PURPOSE: To determine which U.S. osteopathic (D.O.) and allopathic (M.D.) medical schools are formally educating their students on prescription writing and the associated laws and regulations.
METHODS: A survey was mailed to all pharmacology department chairpersons of U.S. D.O. (n=17) and M.D. (n=124) medical schools. The survey inquired if the pharmacology, or other department, courses educated students in the area of prescription writing and its related jurisprudence. The number of hours devoted to this subject, the degrees of those teaching the topic, faculty status (i.e., full-time), and whether the students were tested in any format on the material presented were also assessed.. Chi-squared analysis was utilized for dichotomous data.
RESULTS: Fifteen of 17 D.O. (88.24%) and 97 of 124 M.D. (78.23%) schools responded. Of the 15 responding D.O. schools, the pharmacology department provided the education for eight of the schools (53.33%) and five other courses provided the education in five additional schools (33.34%) for a total of 86.67%. However, only 11 of the 13 schools also provided prescription writing-related jurisprudence education (84.61%). Of the 97 responding M.D. schools, the pharmacology department provided the education for 61 of the schools (62.89%) and 12 other courses provided the education in eight additional schools (8.24%) for a total of 71.13%. However, only 59 of the 69 schools also provided prescription writing-related jurisprudence education (85.51%; p=NS between D.O. and M.D. schools). Of the 13 D.O. schools that teach prescription writing, the mean, median, and mode values for the number of hours the subject was taught were 1.5 hours, 1 hour, and 1 hour, respectively. Of the 69 M.D. schools that teach the topic, the respective values were 1.324 hours, 1 hour, and 1 hour, respectively. Of the eight D.O. pharmacology departments that taught this subject, all eight (100%) tested the students. However, of the 61 M.D. pharmacology departments, only 52 (85.25%) tested the students. The two most common degrees, for those teaching this subject in the pharmacology departments, for the D.O. schools were the Ph.D. (non-pharmacist, n=5) and Pharm.D./R.Ph. (n=3) degrees. The two most common degrees for the M.D. schools were the Pharm.D./R.Ph. (n=31) and Ph.D. (non-pharmacist, n=16) degrees. The majority of the faculty in the D.O. and M.D. schools teaching this subject for the pharmacology courses were full-time faculty (n=7, 63.64%; n=47, 60.26%; respectively). The most common non-pharmacology course that provided this education was the family medicine course for the D.O. schools (n=3, 60%) and the internal medicine course for the M.D. schools (n=4, 33.34%).
CONCLUSIONS: Although there were no statistically significant differences between the D.O. and M.D. medical schools, this study documents that not all U.S. medical students are getting unified, formal education in prescription writing and its related jurisprudence. This data should be of concern for pharmacists who must deal with continued prescription writing errors by physicians.

Endocrinology

54. Evaluation of factors impacting patient decisions to take sibutramine in a managed care environment. *Frances A. Lanty, Pharm.D.*, Anita U.Z. Huttenhower, Pharm.D., Marsha A. Raebel, Pharm.D., FCCP, BCPS, Julie A. Porter, Pharm.D., BCPS; Kaiser Permanente Rocky Mountain Division, Aurora, CO.

PURPOSE: To evaluate factors leading to patients' decisions to begin and discontinue sibutramine therapy in a managed care environment.
METHODS: To describe the demographics and reasons for starting and discontinuing sibutramine, we performed a retrospective analysis of patients attending a sibutramine information and consent form class between May and October 1998. All patients paid retail price for sibutramine. Demographic data collected included gender, age, past anorexiant use, medical history, and body mass index. Factors assessed for impact on the decision to begin or discontinue therapy included cost, concerns with side effects, and other reasons.
RESULTS: A total of 112 patients were evaluated. Seventy-three patients began therapy; 39 patients did not begin therapy. Reasons for not starting sibutramine included patient concern with cost (n=6), patient concern with side effects (n=7), multiple concerns (n=6), and other (n= 6). Fourteen patients did not return for follow up. Sibutramine was discontinued in 14/73 patients for the following reasons: patient concern with cost (n=3), patient did not give reason (n=4), other (n=2), provider discontinued therapy because of side effects (n=2), and drug was ineffective (n=3).
CONCLUSIONS: In patients initially interested in using sibutramine, cost of drug and side effects were the most prohibitive factors in the decision to start or continue therapy. If sibutramine demonstrates sustained safety and efficacy, reduces risks of concomitant conditions, and improves quality of life, it is important that health systems help defray the cost of treatment and address patients' concerns about side effects.

55. Effects of pilocarpine on neuropeptides (substance P and calcitonin gene-related peptide) levels in human plasma and saliva. *Toshiaki Nagano*, Hiroki Itoh, Masaharu Takeyama; Oita Medical University, Oita, Japan.

PURPOSE: Pilocarpine, a cholinergic agonist, can increase secretion by the exocrine glands, such as the salivary gland. The gland is richly supplied with nerve fibers that contain peptides, such as substance P (SP), a stimulator of salivation. SP and calcitonin gene-related peptide (CGRP) are known to coexist in a population of sensory neurons. In addition to measuring sialosis volume, we examined the effects of pilocarpine on neuropeptide levels in human plasma and saliva.
METHODS: For five healthy male subjects, pilocarpine (hydrochloride form, 5 mg) or placebo were orally administered. To measure the neuropeptide levels by enzyme immunoassay, saliva and venous blood samples were taken before and after administration (at 20, 40, 60, 90, 120, 180, and 240 minutes) of the drugs. The sialosis volume was measured by the Saxon test. All values are expressed as means ± SE.
RESULTS: Pilocarpine caused significant increases ($p<0.05$, ANOVA) of saliva SP levels (2.6 ± 0.3 to 7.8 ± 2.6 pg/ml) between 20 and 180 minutes and CGRP (14.9 ± 3.2 to 17.1 ± 2.5 pg/ml) between 60 and 120 minutes after single administration. However, pilocarpine did not alter the levels of plasma SP and CGRP. In placebo groups, the concentrations of saliva SP (about 1.8 pg/ml) and CGRP (about 10.0 pg/ml) appeared to be constant. After administration of pilocarpine, sialosis volumes were significantly increased (1.7 ± 0.3 to 2.6 ± 0.6 ml/5 min) between 40 and 120 minutes.
CONCLUSION: Pilocarpine locally effects SP and CGRP nerves in the salivary gland; elevated SP and CGRP may stimulate production of saliva. This study showed the close connection of SP and CGRP with the enhancement of salivary secretion by pilocarpine treatment.

56E. Efficacy of insulin-metformin combination therapy in patients with type 2 diabetes mellitus. *Linda A. Jaber, Pharm.D.*, Richard L. Slaughter, M.S.; Wayne State University, Detroit, MI.

Published in Diabetes 1998;47:A88.

57. Efficacy of lovastatin 5 mg/day and 10 mg/day in reducing low-density lipoprotein cholesterol. *Joseph J. Saseen, Pharm.D.*, Laura M. Borgelt, Pharm.D., Barry L. Carter, Pharm.D., Julia A. Rawlings, B.S.; University of Colorado Health Sciences Center; Kaiser Permanente Rocky Mountain Division, Denver, CO.

PURPOSE: Although the starting dose of lovastatin is 20 mg/day, lower doses may be effective and may minimize the cost of therapy. This study evaluated low-density lipoprotein cholesterol (LDL-C) lowering and achievement of a goal LDL-C of no more than 130 mg/dl with lovastatin 5 mg/day (Lov5) and 10 mg/day (Lov10).
METHODS: Patients without atherosclerotic vascular disease, at least two NCEP risk factors, and LDL-C between 150-200 mg/dl after at least 6 weeks of diet therapy were included. Patients were randomized (double-blind) to Lov5 (n=20) or Lov10 (n=20) for 6 weeks, followed by a voluntary treatment arm of open-label Lov5 for 6 weeks. Lovastatin was taken once daily with the evening meal. Baseline and treatment cholesterol parameters were compared within patients (paired t-test) and between groups (unpaired t-test).
RESULTS: Mean baseline LDL-C values with Lov5 and Lov10 were similar (173.9 and 168.1 mg/dl, respectively; p=0.14). After 6 weeks of therapy, mean LDL-C was 136.9 mg/dl with Lov5 and 124.2 mg/dl with Lov10 (21.4 and 25.9% reductions; p=0.2). Moreover, 35% (7/20) of Lov5 and 70% (14/20) of Lov10 patients achieved their goal LDL-C (p=0.058, chi squared). Thirty patients completed the Lov5 open-label treatment arm. Mean LDL-C was reduced from 173.0 mg/dl at baseline to 137.5 mg/dl (20.5% reduction); 33% (10/30) of patients achieved goal LDL-C. All LDL-C values were significantly reduced on drug compared to baseline ($p<0.001$).
CONCLUSION: Although this study lacked the power to detect statistical differences between Lov10 and Lov5, both doses were efficacious. LDL-C reductions with both doses are comparable to recommended doses of other statins. These findings suggest that low-dose lovastatin therapy (lower than recommended) is efficacious.

Gastroenterology

58. Phase I, randomized, parallel, placebo-controlled, safety, tolerance, and pharmacokinetic study of single ascending doses of IY-81149 in fasting male volunteers. *Ronald Goldwater, M.D.*, François Boileau, M.S., Seung-Mok Lee, Ph.D., Gi-Ju Chung, M.S.; LAB Pharmacological Research International Inc., Vaudreuil, PQ, Canada.

IY-81149 (IY) is a substituted benzimidazole proton pump inhibitor. In preclinical studies IY has been shown to have similar pharmacologic activities, with increased potency, when compared to omeprazole. Healthy, nonsmoking male subjects (n=24), divided into four groups of six, were randomized within each group to receive a single dose of 5, 10, 20, or 40 mg or matching placebo (four actives and two placebo controls per group). Blood samples (16) were collected before dosing and during the 24 hours following drug administration. Urine was also collected for 24 hours. Vital signs, electrocardiogram, hematology, and biochemistry tests were performed during the study. Blood and urine samples were analyzed by LC/MS/MS and HPLC-UV, respectively. Noncompartmental analysis was used to determine the pharmacokinetic parameters. All 24 subjects completed the study. One subject complained of mild nausea and abdominal cramps. These events were mild, nonserious, and judged unrelated to IY. The mean $AUC_{0\text{-}24}$ (± CV) ranged from 908 (36%) for the 5 mg group to 8888 (21%) ng•hr/ml for the 40 mg group and were dose proportional. The mean C_{max} (± CV) ranged from 129 (28%) after the 5 mg dose to 1605 (19%) ng/ml after the 40 mg dose. The overall half-life was 3.6 (18%) hours. No drug was detected in the urine. We conclude that IY at single doses up to 40 mg is safe and exhibits dose linearity.

59. Phase I, randomized, parallel, placebo-controlled, safety, tolerance, and pharmacokinetic study of multiple doses of IY-81149 in fasting male volunteers. *Ronald Goldwater, M.D.*, François Boileau, M.S., Seung-Mok Lee, Ph.D., Gi-Ju Chung, M.S.; LAB Pharmacological Research International Inc., Vaudreuil, PQ, .

IY-81149 (IY) is a substituted benzimidazole proton pump inhibitor. In preclinical studies IY has been shown to have similar pharmacologic activities, with increased potency, when compared to omeprazole. In this study, 24 healthy, nonsmoking male subjects, divided into two groups of 12, were randomized within each group to receive multiple doses (once daily for 5 days) of either 20 or 40 mg or their matching placebo. Blood samples and urine were collected before dosing and during the 24 hours following drug administration on days 1 and 5. Noncompartmental analysis was used to determine the pharmacokinetic parameters. A total of 24 subjects completed the study. Clinical complaints were reported in two subjects (irritated throat and burning sensation in the stomach). They were judged as nonserious, unlikely to be related to IY, and resolved spontaneously. Mean $AUC_{0\text{-}t}$ on day 1 for the 20 and 40 mg groups were 3932 and 7232 ng•hr/ml, respectively. On day 5, the mean $AUC_{0\text{-}t}$ for the 20 and 40 mg groups were 5041 and 9860 ng•hr/ml. Calculated half-life (mean 4.3 hours) did not differ significantly between dose levels and after multiple dose administration. We conclude that IY, during multiple administration for 5 days, is safe and exhibits dose linearity at doses up to 40 mg.

Geriatrics

60. Evaluation of chronic pain management in a community nursing home. *Shyam D. Karki, Pharm.D.*, Terrance J. Bellnier, MPA, Gule-Rana Masood, M.D., William Patterson, B.S.; Monroe Community Hospital; Rochester Psychiatric Center, Rochester, NY; Clifton Springs Hospital and Clinic.

PURPOSE: This study evaluated the management of chronic pain in a community nursing home.
METHODS: Charts of residents on pain medications were reviewed retrospectively for evaluation of pain management as to demographics, and routine and PRN medication use. They were also interviewed using a graphic pain scale.
RESULTS: Twenty-four (18 females and 6 males) residents were on routine medications for pain management. Mean age was 84 ± 10 years with a range of 65 to 92 years. The number of pain medications per resident was 1.5 and nine different pain medications were used. Acetaminophen was the most often used medication accounting for 21 (60%) single medications and 4 (11%) in combination with others. The most often documented indication was arthritis (75%). Outcomes of pain medication were documented in 15 (63%) residents. Eighteen residents used less than ten doses of PRN pain medications over a 30-day period. Three residents used 10-20 doses, two residents used 20-30 doses, and one resident used more than 30 doses. When residents were interviewed for pain relief using a figure scale on a 5-point scale (0 = no pain and 5 = excruciating pain), only six patients had complete relief; three patients had a 1 score, seven patients had a 2 score, three patients had a 3 score, and one patient had a 4 score.
CONCLUSION: Conventional medication usage evaluation is inadequate for assessing pain management and residents' input needs to be taken into account.

61. Care for elderly in European towns: pharmacologic treatment for osteoporosis in women aged at least 70 years old. Emanuela Fiorio, Pharm.D., *Lorenza Ferraro, Pharm.D.*, Eleonora Marrazzo, Pharm.D., Marilena Romero, Pharm.D., Gianni Tognoni, M.D.; Servizio Farmaceutico Territoriale; Drug Information Centre A.S.L., Torino, Italy; Istituto Mario Negri Sud, S. Maria Imbaro, Italy; Istituto Mario Negri, Milano, Italy.

Senile osteoporosis occurring after the age of 70 is the chief cause of fractures, bone deformities, pain, and disability, occurring primarily as a consequence of falls and a reduction in bone mass.
PURPOSE: The chief aim of this research was to evaluate pharmacologic treatment for osteoporosis in elderly women in the outpatient practice of a sample of general practitioners (GPs).
METHODS: The research was carried out on a sample of 3601 women of at least 70 years, recruited by 247 GPs in 18 European cities in five countries (Italy, France, Spain, Sweden, and Serbia) during June and July 1996. The drugs were codified using the ATC classification; diseases were codified using the ICD-9 system. There were 219 women with a diagnosis of osteoporosis (6% of the total sample).
RESULTS: The drugs prescribed to treat osteoporosis varied with the country in question. In the Italian sample, which comprised 181 women, the most widely used drugs were the bisphosphonates (53% of prescriptions), followed by vitamin D (33%) and calcium salts (23%). In the other European countries, the most prescribed drugs were calcium salts (53% of prescriptions), vitamin D (29%), and calcitonin (21%). Osteoporosis was associated with other diseases in 132 women (60%). The most frequently associated diseases were hypertension, osteoarthrosis, cardiac ischemia, and depression.
CONCLUSIONS: Thanks to the close collaboration between National Health Service pharmacists and GPs, this research has made it possible to give a fairly complete profile of the problems and pharmacologic therapy linked to osteoporosis in women over 70 years of age in the sample recruited.

62E. A randomized double-blind study assessing the optimal dose of doxazosin in treating patients with benign prostatic hyperplasia. Scott A. MacDiarmid, M.D., *Rebecca McGuirt Franklin, Pharm.D.*, Robert T. Emery, M.D., Scott Ferguson, M.D., William J. McIntyre, Pharm.D., Don E. Johnson, M.D.; University of Arkansas for Medical Sciences; John L. McClellan Veterans Administration Hospital, Little Rock, AR.

63. Are elderly nursing home residents with airway obstruction appropriately prescribed steroids? *C. Alice Oborne, M.Sc. Clin.Pharm.*; Ka C. Li, MRCP, Cameron G. Swift, Ph.D., Stephen H.D. Jackson, M.D.; Kings College, London, United Kingdom.

PURPOSE: While asthmatic patients characteristically respond to steroids, only 10-11% of patients with chronic obstructive airways disease benefit (Lancet 1998;351:773-80). Appropriateness of prescribing indicators for elderly inpatients have been developed (Br J Clin Pharmacol 1997;43:91). Modified indicators have been applied in the nursing home (NH) setting. The β_2-agonist and steroid coprescription indicator is presented here.
METHODS: Evidence-based criteria of appropriate steroid prescribing included: 1) proven steroid responsive airways disease, 2) steroid trial with objective monitoring, and 3) another steroid indication. Inappropriate prescribing included steroid use without evidence of benefit and no steroid in asthmatics requiring regular β2-agonists. Medication charts of 933 NH residents aged 65 or over in a random sample of 22 NHs were screened to identify residents taking β_2-agonists. Clinical data were collected from general practitioners and nursing notes to assess prescribing appropriateness.
RESULTS: β_2-agonists were prescribed to 55 residents. Although 23 (42%) were prescribed steroids, only 7 (13%) met criteria for appropriate steroid prescription. Thirty-two (58%) residents received β_2-agonists alone, 25 (45%) appropriately. Assessment of airways obstruction was rarely documented. A total of 32 (42%) residents received inappropriate therapy.
CONCLUSIONS: Grouped prescribing data cannot be used to assess prescribing appropriateness for individual residents with airways obstruction. Clinical data must be used. Elderly nursing home residents with airways obstruction were inadequately assessed and often received inappropriate therapy.

64. Large sample, matched comparison of drug usage in different elderly residential settings. *Chanthonrat Sitthiworanan, B.S.*, David J. Wright, Ph.D., Jonathan Silcock, M.S., Deidre Naylor, Ph.D., June Tordoff, B.S., Henry Chrystyn, Ph.D.; University of Bradford, United Kingdom; Bradford Health Authority, Shipley, United Kingdom.

PURPOSE: To determine whether differences in prescribing patterns exist between matched different elderly groups.
METHOD: Prescription data was collected from all nursing home residents at each consenting practice for the same 6-month period, using a relational database. The residents were then banded into three age groups and the same numbers in each age group were randomly sampled from residential homes and in the community registered with the same practice. Yearly drug costs,

percentage of residents, and number of defined daily dosages (DDDs) prescribed medication were used as prescribing indicators.
RESULTS: Fifteen practices consented to the study. Median prescription cost is stated due to the positive skew in the frequency distribution. Using the Mann-Whitney test, significant differences between groups were seen ($p<0.05$). Percentage of residents (mean number of DDDs) prescribed medication by therapeutic area were:

	Laxative	Hypnotics	Antidepressants	Antipsychotics	Antiplatelet
Community	13.94	14.50 (305.6)	7.72 (131.3)	1.13 (116.9)	14.31 (365.3)
Residential	32.63	21.91 (282.7)	17.25 (224.6)	20.75 (139.3)	24.94 (442.8)
Nursing	47.95	28.73 (264.7)	21.81 (224.5)	26.78 (192.8)	29.37 (416.4)

CONCLUSIONS: The results demonstrate that residents in residential and nursing homes receive significantly more prescriptions than their counterparts in the community. Some of the differences can be explained by the greater number of residents prescribed laxatives, hypnotics, antidepressants, antipsychotics, and antiplatelet drugs. Drugs in the latter three therapeutic areas were also prescribed at higher dosages. Although the research provides no indication of appropriateness of prescribing, pharmaceutical interventions in residential and nursing homes on laxative, antidepressant, and antipsychotic prescribing would seem appropriate.

65E. Initial warfarin therapy outcomes from routine care of elderly inpatients. *Paul R. Kowal, Pharm.D., M.S.*, Lynette Moser, Pharm.D., Ginny Stauffer, Pharm.D., BCPS, Oliver McKeithan, B.S., Jim Hoehns, Pharm.D., Roxie Miles, Pharm.D., Cindy Sanoski, Pharm.D., Trang Vo, Pharm.D., Mary Beth O'Connell, Pharm.D., BCPS.; World Health Organization, Geneva, Switzerland; Wayne State University, Detroit, MI; Methodist Hospital and Lilly Research Laboratories, Indianapolis, IN; Robert Packer Hospital, Sayre, PA; Northeast Iowa Family Practice Center, Waterloo, IA; UHS Hospitals, Johnson City, NY; University of Illinois at Chicago, Chicago, IL; University of Minnesota, Minneapolis, MN.

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Hematology

66E. Treatment of autoimmune thrombocytopenia with anti-D immunoglobulins. *G. Piriou, P.D.*, S. Jobard, P.D., V. LeJeune, P.D., C. Pitre, P.D., C. Balcon, P.D., J.F. Abgrall, Ph.D., N. Borgnis Desbordes, P.D.; Brest University Hospital, Brest Cedex, France.

67. Comparative study of autologous fibrin glues prepared by the centrifuge method, filtration method, or ethanol precipitation method. Hisahiro Yoshida, *Akira Kamiya*; Yamaguchi University Hospital, Yamaguchi, Japan.

PURPOSE: To establish a speedy preparation method for a fibrinogen-rich fraction (FRF), from a patient's autologous plasma using fibrin glue, we compared the concentrations and yields of coagulation factors in FRF prepared by three methods.
METHODS: Human plasma from healthy volunteers was divided into three samples. Two samples were frozen at -20°C in a freezer and defrosted in a 4°C water bath. One sample of defrosted plasma was centrifuged and FRF was obtained (C method). Another sample of defrosted plasma was filtrated and FRF was obtained (F method). The last sample was treated with cold ethanol (1/10) in a 4°C water bath and FRF was obtained after centrifugation (E method).
RESULTS: The results were as follows: 1) the volume of FRF by the E method was greater than that by the C and F method and the variation by the E method was the lowest among the three methods; 2) the concentrations and yields of fibrinogen and Factor XIII in FRF by the E method were significantly higher than those by the C and F methods; 3) the concentration and yield of fibronectin in FRF by the E method were similar to those by the C method; and 4) the preparation time of FRF by the E method was about 1 hour and was the shortest among the three methods.
CONCLUSIONS: These results indicate that high quality FRF from a patient's autologous plasma could be prepared easily and within 1 hour by the E method.

68. Evaluation of the use of a portable unit versus the hospital laboratory for monitoring international normalized ratio. *Camilla M.L. Wong, B.Pharm.*, Maggie M.Y. Lim, B.S., Lai H. Lee, M.B.B.S.; Curtin University of Technology; University of Singapore, Singapore.

PURPOSE: Measuring the international normalized ratio (INR) through a laboratory requires venipuncture and takes about 1 hour for results to be available. A portable monitor, CoaguChek Plus System, which measures the INR using fingerstick samples, is evaluated in this study to determine its clinical significance in anticoagulated and non-anticoagulated individuals. The hospital's outpatient and inpatient laboratories were also compared in the study.
METHOD: Paired venous and capillary blood INRs were performed on anticoagulated patients using the monitor and the outpatient and inpatient laboratories (OPS and IPS lab). Paired INR of control samples were also performed using the monitor and the IPS lab.
RESULTS: We plotted the difference in INR by the two methods (monitor and OPS lab, n=91) against their mean and calculated the limits of agreement (95% of the difference would lie between -0.90 to 0.70). After logarithmic transformation of the data, we found that for 95% of the cases, the OPS lab would differ from monitor by 13% below to 14% above. There was also a marginal difference (95% limits of agreement of -0.14 to 0.10) when we compared the INR obtained from OPS and IPS laboratories (n=43). Our control sample (n=19) showed that the 95% confidence interval for the bias was -0.04 to 0.10.
CONCLUSION: The monitor should be used with caution in patients with INR greater than 3.0. We suggest the use of the monitor in situations where the non-anticoagulated state of a patient needs to be measured. There is a difference in INR measured by laboratories within the same institution.

HIV/AIDS

69. The influence of dose and food on didanosine systemic exposure in HIV-infected children. *Robert C. Stevens, Pharm.D.*, Lisa M. Frenkel, M.D., John R. Rodman, Pharm.D. for the Pediatric ACTG 144 Protocol Team; St. Jude Children's Research Hospital; University of Tennessee, Memphis, TN; Children's Hospital and Medical Center; University of Washington, Seattle, WA.

Bioavailability of didanosine (ddI) in adults has been shown to be variable, incomplete (f=20–50%), and subject to food effect; thus, administration on an empty stomach is recommended. However, there are limited data in children and this constraint complicates therapy and limits compliance.
PURPOSE: To determine variability in ddI systemic exposure in fasting and fed states at low and higher doses during maintenance therapy of HIV infection in children.
METHODS: Symptomatic HIV-infected children (2–18 years) enrolled in the pediatric ACTG 144 protocol received ddI oral solution at a dose of either 50 mg/m^2 (n=38) or 150 mg/m^2 (n=38) every 12 hours as part of an efficacy trial. The disposition of ddI was evaluated during both fasted and fed conditions for each child. Serial blood samples (n=7) were collected up to 4 hours post-dosing and a 1-compartment absorption model was fit to the ddI plasma concentrations.
RESULTS: Listed are the median (CV%) parameters from the 76 evaluable patients. There were no significant differences for any parameter estimates between the two dosing groups.

	AUC† (μg/L·hr)	CL_{oral} (L/hr/m^2)	K_{azero} (hr^{-1})	f (%)	T_{max} (hr)	C_{4h} (50 mg/m^2) (μg/L)	C_{4h} (150 mg/m^2) (μg/L)	$t_{1/2}$ (hr)
Fast	373 (55)	134 (54)	0.41 (65)*	0.25 (51)*	0.4 (70)*	12 (67)*	46 (68)*	0.8 (46)*
Fed	388 (47)	129 (61)	0.51 (95)	0.18 (49)	0.6 (94)	20 (66)	65 (70)	1.2 (46)

† normalized to 50 mg/m^2 dose; *$p<0.01$, compared to fed condition

CONCLUSIONS: Consistent with studies in adults, ddI absorption fraction is lower with food. However, ddI systemic exposure (i.e., AUC) is similar with or without food because of prolonged absorption time in the fed state as evidenced by higher C_{4h} values. Variability in K_a and T_{max} is greater with food but AUC is similar.

70. Increased intracellular concentrations of zidovudine in hydroxyurea pre-treated human umbilical vein endothelial cells. *Timothy R. McGuire, Pharm.D.*, Eric Hoie, Pharm.D., Peter Gwilt, Ph.D., Don Miller, Ph.D., Konstantine Manouilov, Ph.D.; University of Nebraska Medical Center, Omaha, NE.

Human umbilical vein endothelial cells (HUVEC) have been shown to be a transient sanctuary for HIV and may be involved in the in utero transmission of HIV to the fetus. Zidovudine (ZDV) during the second and third trimester is used to reduce in utero transmission of HIV but is as a regimen is too expensive for third world countries. Shorter courses of ZDV have recently been studied, reporting approximately a 50% failure rate. To further reduce transmission with short course regimens more intense therapy may be required. The intracellular retention and activity of ZDV requires conversion to the triphosphate form. Hydroxyurea pre-treatment has been shown to increase ZDV-triphosphate in mononuclear cells by inhibiting ribonucleotide reductase and reducing deoxynucleoside pools. In the following experiments we pre-treated HUVEC with 0.1, 0.5, and 1.0 mM of hydroxyurea for 24 hours followed by 100 ng/ml of ^{3}H-ZDV. Maximal retention of ^{3}H-ZDV occurred at a hydroxyurea concentration of 0.1 mM resulting in a 72% increase in intracellular ^{3}H-ZDV. Concentrations of intracellular ^{3}H-ZDV were not increased at hydroxyurea concentrations of 0.5 or 1.0 mM. The explanation for this concentration effect remains unclear and is an active area of investigation in our laboratory. The described study demonstrates that at hydroxyurea concentrations which can be obtained after low doses, there is increased intracellular accumulation of ZDV and this may be a useful combination in pregnant women.

71E. Diabetes and use of protease inhibitors. *Betty J. Dong, Pharm.D.*, Cristina Gruta, Pharm.D.; University of California San Francisco, San Francisco, CA.

Presented at the 12th World AIDS Conference, Geneva, Switzerland, June 28-July 3, 1998.

72E. Effects of GMCSF on the pharmacokinetics of indinavir in HIV-infected patients. *Khurram Z. Rana, Pharm.D.*, Chukwuemeka S. Okereke, Ph.D., Kathy Melbourne, Pharm.D., Kelly A. Simmons, B.A., Michael N. Dudley, Pharm.D., FCCP, Gail Skowron, M.D., Karen Burke, B.S.N., Dennis Mikolich, M.D., Anne Mongillo; University of Rhode Island; Brown University AIDS Program; Roger Williams Medical Center, Providence, RI; Immunex Corp., Seattle, WA.

Presented at the 38th Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 24-27, 1998.

73E. Comparison of azithromycin leukocyte disposition in healthy volunteers versus volunteers with AIDS. JoCarol McNabb, Pharm.D., Rob Owens, Pharm.D., Da-wei Xuan, B.S., Richard Quintiliani, M.D., Charles Nightingale, Ph.D., *David Nicolau, Pharm.D.*; Hartford Hospital, Hartford, CT.

Presented at the 2nd International Meeting on Therapy on Infections, Florence, Italy, Nov. 18-21, 1998.

74E. Mononuclear and polymorphonuclear leukocyte disposition of clarithromycin and azithromycin in AIDS patients requiring *Mycobacterium avium* complex prophylaxis. Khanh Q. Bui, Pharm.D., JoCarol J. McNabb, Pharm.D., Charles H. Nightingale, Ph.D., *David P. Nicolau, Pharm.D.*; Hartford Hospital, Hartford, CT.

Presented at the 36th Annual Meeting of the Infectious Diseases Society of America, Denver, CO, November 12-15, 1998.

Infectious Diseases

75. Pharmacokinetics and pharmacodynamics of cefepime after intermittent bolus and continuous infusion. *David S. Burgess, Pharm.D.*, Rhonda W. Hastings, Pharm.D., Thomas C. Hardin, Pharm.D.; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: To evaluate the pharmacokinetics (PK) and pharmacodynamics (PD) of cefepime (CFP) by intermittent (IB) and continuous infusion (CI) against common pathogens.
METHODS: The PK and PD of CFP were evaluated in a randomized crossover study after IB and CI administration in 13 normal volunteers (six male, seven female). Each subject received CFP 2 g q12h for 2 doses and CI 4 g or 3 g over 24 hours. Serum samples were collected at 15 predetermined times over 24 hours. Additional samples were taken at 13, 18, and 24 hours for PD analysis. The serum concentrations were determined in duplicate by HPLC. SITs and SBTs were performed by microdilution against four clinical isolates each of *P. aeruginosa* (PA), *S. aureus* (SA), and *E. cloacae* (EC). PK parameters were determined using noncompartmental analysis. Serum concentration time profiles were simulated for each patient and the time above the MIC was determined for each organism.
RESULTS: The PK parameters (mean ± SD) for IB were: C_{max} 140.7 ± 25.5 µg/ml, C_{min} 1.5 ± 0.6 µg/ml, $t_{1/2}$ 2.0 ± 0.2 hr, TBCL 7.9 ± 1.9 L/hr, and V_{ss} 23.3±6.0 L. The C_{ss} for 4 g and 3 g CI were 20.5 ± 2.7 µg/ml and 13.7 ± 1.4 µg/ml, respectively. The MICs/MBCs (µg/ml) for PA, SA, and EC were 2-4/4-8, 2-4/4-8, and 0.0625-8/0.125-8, respectively. For IB, the SIT/SBTs at 13 hours and 18 hours were ≥ 1:16/1:8 and ≥ 1:4/1:2 for all organisms. However, at 24 hours, SIT/SBTs were < 1:2 for isolates with a MIC ≥ 2 µg/ml. For EC (MICs 0.06 and 0.5 µg/ml), SITs/SBTs at 24 hours were ≥ 1:16/1:8 and ≥ 1:4/1:2. For CI 4 g and 3 g, no difference in SIT/SBTs were observed. CI CFP SIT/SBTs at steady state were ≥ 1:4/1:2 for all isolates. Concentrations remained above the MIC for the entire dosing interval for organisms with an MIC £ 1 µg/ml and at least 50% of the dosing interval for organisms with an MIC of 4-8 µg/ml.
CONCLUSION: Hence, CI CFP with 3 g/day provides a better PD profile than IB 2 g q12h for organisms with MICs ≥ 2 µg/ml. Therefore, clinical studies are warranted to evaluate CI CFP.

76. Differences in fluoroquinolone pharmacodynamic profiles against common pathogens. *Charles R. Bonapace, Pharm.D.*, Roger L. White, Pharm.D., John A. Bosso, Pharm.D.; Medical University of South Carolina, Charleston, SC.

The pharmacodynamic parameter most associated with efficacy of fluoroquinolones is the ratio of the 24-hour area under the serum concentration-time curve/minimum inhibitory concentration ratio (AUC/MIC). Using literature pharmacokinetic values and dosing regimens recommended in the package insert, we simulated free (unbound) steady-state serum concentration-time profiles for a 70 kg adult assuming a 1-compartment model for six drugs: IV and PO ciprofloxacin (C), ofloxacin (O), levofloxacin (L), and trovafloxacin (T); and PO sparfloxacin (S) and grepafloxacin (G) at creatinine clearances (CrCl) of 100, 75, 50, 25, and 5 ml/min. Steady-state 24-hour AUCs were calculated. Weighted geometric mean MIC_{90} values were calculated from data collected from multiple peer-reviewed studies (minimum total of 9169 organisms evaluated) for *S. pneumoniae*, *E. coli*, *P. aeruginosa*, *K. pneumoniae*, *S. marcescens*, and *E. cloacae* and used to calculate an AUC/MIC ratio for each drug at each CrCl against each organism. The daily doses (mg/day) necessary to achieve a target AUC/MIC ratio of 100, which has been associated with clinical efficacy in serious infections, were as follows: C IV 54-5020 mg/day, C PO 78-7171 mg/day, L IV 18-4999 mg/day, L PO 18-5050 mg/day, O IV 28-7048 mg/day, O PO 28-7191 mg/day, T IV 29-2512 mg/day, T PO 33-2855 mg/day, S PO 32-3,839 mg/day, and G PO 471-38,515 mg/day. These doses were also expressed as a percentage of the daily doses recommended in the package insert. ANOVA with Fisher's PLSD post-hoc testing was used to assess differences among drugs for each organism. For each organism, the drugs with the lowest and highest percentages were as follows: *S. pneumoniae* (T IV 60%, C PO 758%), *E. coli* (L IV/PO 8%, G PO 94%), *P. aeruginosa* (C IV 584%, G PO 2827%), *K. pneumoniae* (L IV/PO 43%, S PO 176%), *S. marcescens* (L IV/PO 27%, G PO 7703%), and *E. cloacae* (L IV/PO 37%, G PO 281%). Higher percentages vs other drugs ($p<0.0001$) were found for G PO and T IV/PO for *E. cloacae*, S PO and T PO for *K. pneumoniae*, and G PO for *S. marcescens*. Except against *E. coli,* many of these agents at currently recommended doses may be inadequate as monotherapy for serious infections caused by these pathogens.

77. The effect of microbial growth mode on antimicrobial susceptibility. *Colin G. Adair, Ph.D.*, Sean P. Gorman, Ph.D., Barbara M. Feron, Ph.D.; The Queen's University of Belfast, Belfast, Northern Ireland, United Kingdom.

PURPOSE: Our previous work has implicated microbial biofilm in medical device-related infection. However, the use of minimum inhibitory concentrations (MIC), performed using suspensions of cells (planktonic growth), does not adequately describe the in vivo susceptibility of biofilm mode. As a biofilm, pathogens adherent to tissue and indwelling medical devices are metabolically quiescent and cells are protected from biocides and host defenses. Therefore, the aim of this study is to compare the susceptibility of microorganisms in the biofilm growth form with that of the planktonic form.
METHODS: Isolates of *P. aeruginosa* (six), *S. aureus* (six), and *Enterobacteriacae* (four) were recovered from the biofilm of endotracheal tubes from 16 patients with ventilator-associated pneumonia. Pathogen susceptibility to tobramycin, cefotaxime, and cefuroxime was characterized by standard planktonic MIC and minimum bactericidal concentrations (MBC) methods and compared to their susceptibility while in biofilm growth mode, the latter permitting only the determination of MBCs.
RESULTS: Data for planktonic susceptibility showed the majority of isolates to be susceptible to concentrations of antibiotic associated with conventional doses (tobramycin < 10 mg/L; cefotaxime < 16 mg/L; cefuroxime < 16 mg/L), although *P. aeruginosa* was insensitive to cefuroxime. As expected, planktonic MBCs were several dilutions higher than corresponding MICs, but were significantly lower ($p=0.002$) than MBCs from isolates in biofilm growth mode (> 1024 mg/L).
CONCLUSION: Microorganisms associated with device-related infection, by virtue of their metabolic quiescence and glycocalyx-mediated protection from host defenses and biocides, are less susceptible to antimicrobial action. These data highlight the problem of eradicating pathogens in the biofilm form and show that greater recognition must be given to this form of growth in developing strategies to prevent or eradicate medical device-related infection.

78. Amphotericin B bladder irrigations are not effective in eradicating catheter-associated funguria. *Karen A. Kostiuk, Pharm.D.*, Richard A. Jacobs, M.D., Marshall L. Stoller, M.D., B. Joseph Guglielmo, Pharm.D.; University of California San Francisco, San Francisco, CA.

PURPOSE: Amphotericin B bladder irrigation is accepted as standard treatment of catheter-associated funguria. Controlled trials to document its benefit are limited. A randomized, prospective, controlled trial was conducted to determine the efficacy of amphotericin B bladder irrigations for catheter-associated funguria.
METHODS: We compared amphotericin B bladder irrigation and change of Foley catheter (group A) with catheter change alone (group B) for patients with uncomplicated funguria. Patients in group A received amphotericin B bladder irrigations, 25 mg/L, for 4 days with a Foley catheter change on day 2 of therapy. Patients in group B only underwent a catheter change on day 2. Follow-up fungal urine cultures were obtained on days 2 and 5.
RESULTS: Positive fungal urine cultures were identified in 179 patients. Ninety-one patients were excluded; 88 patients were eligible to enter the study. Sixteen patients with catheter-associated funguria were enrolled and randomized to one of two groups. Follow-up urine cultures were obtained for 13 of the 15 patients who completed the study. Evaluation at day 5 revealed that four of eight amphotericin B-treated patients had negative cultures compared to zero of seven patients in group B ($p=0.05$). No patient developed a systemic fungal infection. Amphotericin B exhibited a transient microbiologic effect. Independent of treatment group, all patients subsequently had positive urine cultures for yeast at follow up. No patients had long-term microbiologic cure.
CONCLUSIONS: Neither amphotericin B bladder irrigations nor catheter change alone were associated with long-term microbiologic eradication of yeast from the urine while a Foley catheter was in place.

79. Inappropriate use of vancomycin and teicoplanin in a medical center. *Yea-Huei K. Yang, B.S.*, Wen-Liang Lin, M.S., Wen-Chien Ko, M.D., Yin-Ching Chuang, M.D., Kin-Wei A. Chan, M.D., Sc.D.; National Cheng Kung University Hospital, Tainan, Taiwan; National Taiwan University, Taiwan.

PURPOSE: This study evaluated the appropriateness of glycopeptide prescriptions and the influence of interventions, and estimated the cost of inappropriate use.
METHODS: The study was designed as a bi-phase drug use evaluation, including retrospective evaluation, intervention, and evaluation during the intervention phase. Evaluations were conducted based on criteria developed by the infection control committee and pharmacy department of the National Cheng Kung University Hospital. The retrospective phase was from August 1, 1997 to September 30, 1997, and the intervention phase was from February 1, 1998 to May 13, 1998. Intervention methods were educational, including a criteria booklet, commentary articles on pharmacy forum, a letter to physicians, and a feedback report.
RESULTS: There were 225 and 296 cases eligible for inclusion in each phase. The majority of inappropriate uses were empiric use for suspected infections, continued use for patients whose cultures were negative for β-lactam resistant gram positive cocci, and routine surgical prophylaxis. There was no significant improvement in the percentage of appropriate use between the two phases (p=0.26). The usage for routine surgical prophylaxis from the department of ophthalmology decreased significantly in the intervention phase (p=0.022), while the inappropriate use in the department of pediatrics increased significantly (p=0.043). Estimated annual cost of inappropriate use of glycopeptides was NT $3,215,417, or $91,869 U.S. dollars, approximately one-sixth of the annual expenditure of glycopeptides.
CONCLUSIONS: The effect of educational interventions were limited and transient, only resulting in a slight increase in the percentage of appropriate use. It is important to maintain the intervention and assure the sustained influence on appropriate use of glycopeptides.

80. Comparative bactericidal activity of vancomycin and levofloxacin against planktonic versus sessile cells of *Staphylococcus epidermidis*. *S. Lena Kang-Birken, Pharm.D.*; University of the Pacific, Stockton, CA; Cottage Hospital, Santa Barbara, CA.

PURPOSE: *Staphylococcus epidermidis* often adhere to a medical device and, with the production of exopolysaccharide, the cells become embedded in this matrix. These sessile cells appear to be less susceptible to antibiotics than free-floating or planktonic cells. We studied the difference in killing activity of vancomycin (V) and levofloxacin (L) alone and combined with rifampin (R) against planktonic versus sessile cells.
METHODS: MICs and MBCs of the above antibiotics were determined by broth microdilution against a clinical isolate of methicillin-resistant *S. epidermidis* (MRSE 23) and a reference strain of MRSE (ATCC 35984). Time-kill studies were performed in duplicate using antibiotic concentrations achievable in human (V 30 µg/ml; L 5 µg/ml; R 8 µg/ml). The samples, collected at 0, 2, 4, 6, 8, and 24 hours, were plated and counted.
RESULTS: MICs/MBCs of V, L, and R against MRSE 23 and ATCC 35984 were 0.78/0.78, ≤ 0.19/≤ 0.19, ≤ 0.19/≤ 0.19 µg/ml, and 0.78/1.56, ≤ 0.19/≤ 0.19, ≤ 0.19/≤ 0.19 µg/ml, respectively. A total of 99.9% killing activity was seen with V, L, and V plus L against planktonic cells of MRSE 23 (18.86, 21.30, and 17.48 hours, respectively) and with L (21.48 hours) against ATCC 35984. Overall activity was severely compromised against both strains of sessile cells. No mono- or combination regimen achieved 99.9% killing activity. While combination with R was antagonistic against both strains of planktonic cells, it had additive effect against sessile cells.
CONCLUSION: Antimicrobial activity typically reported using nutrient-rich, planktonic cells may not be applicable against sessile cells under environmental and growth restrictions. Addition of R may have unpredictable outcome in overall killing activity against MRSE.

81E. Multidrug resistant tuberculous meningitis: a case report of novel treatment with intrathecal levofloxacin and amikacin. Teresa Ann Cherry, M.D., *Shaun E. Berning, Pharm.D.*, Michael D. Iseman, M.D.; National Jewish Medical and Research Center; University of Colorado, Denver, CO.

Presented at the Global Congress on Lung Health 29th World Conference of the International Union Against Tuberculosis and Lung Disease, Bangkok, Thailand, November 1998.

82. The fungus among us. *Phillip R. Treadwell, Pharm.D.*, Dennis Mungall, Pharm.D., Saeed Tarokh, M.D., Kellie J. Krasinski, B.S.N., Bill Wasserman, Pharm.D., Gregory Blair, Pharm.D., John Siebold, Pharm.D.; Tallahassee Memorial Healthcare, Tallahassee, FL.

PURPOSE: Our purpose was to investigate whether positive fungal cultures from any site, whether documented as infection or not, would have a negative impact on length of stay (LOS) in the hospital and intensive care unit (ICU) and on mortality.
METHODS AND RESULTS: Two hundred twenty-four charts were retrospectively reviewed. One hundred seventy-five had at least one positive fungal culture (PFC), and 49 had no positive fungal cultures (NFC). Patients in both groups were similar with regard to all baseline demographic characteristics assessed except for age (PFC 66.9 ± 15.9 years vs NFC 59.4 ± 19.2 years; p<0.05). Regression analysis revealed that PFC was associated with increased mortality (percentage surviving hospital stay = [-50 x liver disease] - [3 x serum creatinine] + [17 x non-gastrointestinal abdominal surgery] - 15 broad spectrum antibiotic use - [15 x PFC] - [23 x HIV positive] - [17 x cardiac surgery] + 7 cephalosporin use + 117; r=0.27, p<0.01) and increased LOS (in days = [9.8 x gastrointestinal surgery] - [3.6 x albumin] + [4.3x PFC] + [0.68 x LOS in ICU] + 17; r=0.81, p<0.00001). Regression analysis indicates that patients with PFC who received antifungal therapy, primarily fluconazole, had 1.9 days shorter LOS in the hospital than did those who did not receive antifungal therapy.
CONCLUSION: We have performed a retrospective review of mainly intensive care unit patients and found that any positive fungal culture from any body site may have a deleterious impact on intensive unit and hospital stay. Patients treated with an antifungal have shorter hospital stays. Increased mortality was associated with having a fungal infection. Early intervention and recognition may be an effective way of improving this picture. Prospective interventional evaluations will have to be performed in our population to assess this directly.

83. Antifungal activities of fluconazole, LY303366, and MK0991, alone and in combination, against *Candida sp.* and *Cryptococcus neoformans* via time-kill methods. Ashley Wasson, *Michael E. Klepser, Pharm.D.*, Russell E. Lewis, Pharm. D., Erika J. Ernst, Pharm.D., Michael A. Pfaller, M.D.; University of Iowa, Iowa City, IA.

PURPOSE: To evaluate the activities of the echinocandins LY303366 (LY) and MK0991 (MK) alone and in combination with fluconazole (FLU) using time-kill methods.
METHODS: Two isolates each of *C. albicans*, *C. glabrata*, *C. tropicalis*, *C. krusei*, and *C. neoformans* were tested against each drug at two concentrations. Combinations tested were high concentration FLU (20 µg/ml) with high concentration (2 µg/ml) MK or LY and low concentration FLU (0.5 µg/ml) with low concentration (0.007 µg/ml) MK or LY. RPMI 1640 with MOPS served as growth media. The starting inocula was approximately $5x10^5$ CFU/ml. Samples were removed at predetermined time points, diluted, and plated on potato dextrose agar for colony counting. All tests were performed in duplicate. Log_{10} CFU/ml versus time plots were constructed and evaluated for activity to characterize fungicidal (≥ 99.9% reduction in CFU/ml compared to the starting inoculum) or fungistatic (< 99.9% reduction) activity. Combination regimens were further evaluated for synergy (≥ 2 log decrease in CFU/ml between the combination and the most active agent alone), antagonism (> 2 log increase in CFU/ml between the combination and the most active agent alone), or indifference (no change from the most active agent alone).
RESULTS: FLU alone produced fungistatic activity against all isolates except *C. krusei* and *C. glabrata*, for which it displayed no apparent activity. LY and MK alone at low concentrations exhibited fungistatic activity against all candida isolates; however, fungicidal activity was achieved against some candida isolates at the high concentration. LY and MK displayed no activity against *C. neoformans* isolates. In general, the combination of FLU plus LY or MK displayed indifference.
CONCLUSIONS: Combinations of FLU plus MK or LY do not display synergy or antagonism with respect to the activity of the echinocandin used alone when tested by time-kill methods in vitro.

84. Evaluation of voriconazole pharmacodynamic activity using time-kill methodology. Dennis Malone, Pharm.D. candidate, Russell E. Lewis, Pharm.D., Erika J. Ernst, Pharm.D., Michael A. Pfaller, M.D., *Michael E. Klepser, Pharm.D.*; University of Iowa, Iowa City, IA.

PURPOSE: Voriconazole is a new broad-spectrum triazole antifungal with enhanced activity against *Candida, Cryptococcus*, and *Aspergillus spp.* Using time-kill methodology, we evaluated the antifungal activity of voriconazole against two fluconazole (FLU)-susceptible *Candida albicans* isolates, two isolates of *Candida glabrata* (one FLU-susceptible, one FLU-resistant), two isolates of *Candida tropicalis* (one FLU-susceptible, one FLU-resistant), and two isolates of *Cryptococcus neoformans* (both FLU-susceptible).
METHODS: A standardized fungal inocula of each isolate was added to tubes containing growth media (RPMI 1640 buffered with MOPS) and voriconazole at concentrations ranging from 0-16 x MIC. Tubes were then incubated on an orbital shaker at 35°C for 24 hours. At predetermined timepoints during the incubation, samples were removed, serially diluted, and plated on potato dextrose agar for colony count determination. All time-kill studies were run for 24 hours and performed in duplicate. Data from individual runs were averaged and plotted on a log_{10} scale as CFU/ml verses time to characterize fungicidal (≥ 99.9% reduction in CFU/ml from starting inoculum) or fungistatic (< 99.9% reduction) activity.
RESULTS: Against all isolates, voriconazole exhibited fungistatic activity at concentrations ≥ 1 x MIC. For *C. neoformans*, *C. glabrata*, and one isolate of *C. tropicalis*, voriconazole concentrations > 1 x MIC did not increase the rate or extent of fungistatic activity. For both isolates of *C. albicans* and one isolate of *C. tropicalis*, fungistatic activity was improved with increasing voriconazole concentrations up to 4 x MIC.

CONCLUSION: We found voriconazole to be effective against both FLU-susceptible and FLU-resistant candida isolates. In vitro, fungistatic activity of voriconazole was maximized as drug concentrations approached 4 x MIC.

85. Comparative pharmacodynamics of five β-lactams against common nosocomial pathogens. *Michael B. Kays, Pharm.D.*; Purdue University, Indianapolis, IN.

For β-lactams, time above the MIC (T > MIC) is the pharmacodynamic (PD) parameter that best correlates with clinical outcome.
PURPOSE: To compare the PD of cefepime (CFP), ceftazidime (TAZ), piperacillin (PIP), piperacillin/tazobactam (P/T), and imipenem (IMI) versus *E. coli* (EC), *K. pneumoniae* (KP), *S. marcescens* (SM), oxacillin-susceptible *S. aureus* (SA), *C. freundii* (CF), *E. aerogenes* (EA), *E. cloacae* (ECL), and *P. aeruginosa* (PSA).
METHODS: Using a 2-compartment model, serum concentration-time profiles were simulated for a 70 kg patient with a CrCl ranging from 30-120 ml/min. Dosing regimens were adjusted for CrCl as recommended in each product package insert, and all profiles were adjusted for protein binding. Using published studies, a weighted geometric mean (GM) MIC_{90} was calculated for each drug-organism combination. T > MIC was calculated as the percentage of the dosing interval that free concentrations remained above the GM MIC_{90}. Desirable PD was defined as a T > MIC for ≥ 60% of the dosing interval for all organisms, except *S. aureus* (≥ 40%).
RESULTS: At each CrCl, CFP achieved desirable PD for the most organisms, followed by IMI. At a CrCl = 100 ml/min, desirable PD was achieved for the following: CFP 1 g q12h against EC, KP, SM, SA, CF, EA, and ECL; TAZ 2 g q8h against EC, KP, and SM; PIP 4 g q6h against none tested; P/T 4.5 g q8h against SA; and IMI 0.5 g q6h against EC, KP, SA, CF, and ECL. At a CrCl = 50 ml/min, desirable PD was achieved for the following: CFP 1 g q24h against EC, KP, SM, SA, CF, EA, and ECL; TAZ 2 g q12h against EC, KP, SM, and SA; PIP 4 g q6h against none tested; P/T 4.5 g q8h against EC and SA; and IMI 0.5 g q8h against EC, KP, SA, CF, and ECL. No β-lactam achieved desirable PD for PSA.
CONCLUSIONS: CFP 1 g q12h (CrCl > 60) and 1 g q24h (CrCl £ 60) achieves desirable PD for many common nosocomial pathogens, including CF, EA, and ECL. IMI also provides desirable PD for most of these organisms, except SM and EA. TAZ, PIP, and P/T do not provide desirable PD for most of these organisms. Based on PD, combination therapy should be considered for PSA.

86. In vitro activity and pharmacodynamics of oral β-lactam antibiotics versus clinical isolates of *S. pneumoniae* exhibiting intermediate penicillin resistance. Karriann K. Wood, Pharm.D., *Michael B. Kays, Pharm.D.*, Donald O. Miles, Ph.D.; Purdue University, Indianapolis, IN; Saint Francis Medical Center, Cape Girardeau, MO.

Animal and human data suggest that the time above the MIC (T > MIC) for β-lactams should be at least 40% of the dosing interval when treating pneumococcal infections.
PURPOSE: To compare the in vitro activity and pharmacodynamics (T > MIC) of amoxicillin (A), amoxicillin plus clavulanic acid (AC), cefprozil (CFP), cefuroxime (CFM), cefpodoxime (CPX), cefaclor (CF), and loracarbef (L) against *S. pneumoniae* (SP).
METHODS: MICs were determined by Etest for 108 clinical (non-duplicate) isolates of SP obtained from infected patients in Cape Girardeau, MO. MIC_{50} and MIC_{90} were calculated. Pharmacokinetic variables were obtained from the literature, and serum concentration time profiles were simulated using FDA approved pediatric doses (assuming a 25 kg child). T > MIC (percentage of dosing interval) was calculated using free concentrations and the MIC for each isolate. ANOVA (Scheffe post-hoc test) was used to determine differences among agents in in vitro activity, after logarithmic transformation of MIC data, and T > MIC (level of significance, $p<0.05$).
RESULTS: Penicillin resistance (MIC > 0.06 µg/ml) was detected in 29% (31/108) of the isolates. Twenty-five isolates exhibited intermediate resistance. For these 25 isolates, the MIC_{50}/MIC_{90} values were as follows: A, 0.25/0.75; AC, 0.19/0.75; CFP, 0.75/8; CFM, 0.5/4; CPX, 0.5/2; CF and L, 2/48. A and AC were significantly more active than CFP, CF, and L. The percentage of these 25 isolates in which T > MIC was at least 40% was 100% for A (13.3 mg/kg) and AC (13.3 mg/kg), 96% for AC (22.5 mg/kg), 72% for CFP (15 mg/kg) and CPX (5 mg/kg), 68% for CFM (15 mg/kg), 40% for CF (10 mg/kg), and 32% for L (15 mg/kg). T > MIC for A and AC (13.3 mg/kg) was significantly longer than all other β-lactams. T > MIC for AC (22.5 mg/kg) was significantly longer than CFM, CF, and L only. CONCLUSION: A and AC have superior in vitro activity and longer T > MIC for intermediate resistant SP compared to these other oral β-lactams.

87E. Infusion-related toxicities of lipid-based amphotericin B formulations. *Kara A. Harrer, Pharm.D.*, Lori Hollis, Pharm.D., Carlton K.K. Lee, Pharm.D., M.P.H.; The Johns Hopkins Hospital, Baltimore, MD.

Presented at the Eastern States Residency Conference, Baltimore, MD, April 19, 1998.

88. Antagonism of ticarcillin/clavulanic acid and trimethoprim/sulfamethoxazole given in combination against *S. maltophilia* in an in vitro model. *Kenneth C. Lamp*, Andrew H. Strayer, Neil E. Klutman, Collin D. Freeman; University of Missouri at Kansas City; VA Medical Center, Kansas City, MO; PPD Pharmaco, Inc., Wilmington, NC; University of Kansas; Bayer Pharmaceuticals.

PURPOSE: Treatment of *S. maltophilia* is complicated by innate antimicrobial resistance and lack of clinical data. Some have recommended combination therapy, although the optimum treatment for *S. maltophilia* has not been determined. The study purpose was to investigate the activity of ticarcillin/clavulanic acid (TC/CL) or trimethoprim/sulfamethoxazole (TMP/SMX) alone and in combination against *S. maltophilia* in an in vitro infection model.
METHODS: Two clinical isolates were investigated. *S. maltophilia* F7521 was TC/CL sensitive (MIC = 4/2 µg/ml) and TMP/SMX resistant (MIC = 16/304 µg/ml). *S. maltophilia* 315C was TC/CL resistant (MIC ≥ 128/2 µg/ml) and TMP/SMX sensitive (MIC = 0.25/4.75 µg/ml). Susceptibility testing was completed using macrodilution techniques in supplemented Mueller Hinton broth. The experiments were conducted over 24 hours utilizing a 2-compartment in vitro model with antibiotic concentrations simulating human pharmacokinetics. Antibiotics were bolused to simulate TC/CL 3.1 gm every 6 hours or TMP/SMX 420/2100 mg every 12 hours. The *S. maltophilia* isolates were exposed to each antibiotic alone and in combination at a starting inoculum of 10^6 CFU/ml.
RESULTS: The colony counts at 24 hours for TC/CL, TMP/SMX, and TC/CL+TMP/SMX for F7521 were 1.39, 8.17, and 2.95, respectively ($p<0.05$ for all comparisons). For 315C, the colony counts at 24 hours for TC/CL, TMP/SMX, and TC/CL+TMP/SMX were 8.51, 1.74, and 4.80, respectively ($p<0.05$ for all comparisons). Both antibiotics were bactericidal against their respective sensitive strains; however, TC/CL was more rapidly bactericidal than TMP/SMX alone (6.5 vs 9.6 h). Antagonism was seen for the combinations against both strains.
CONCLUSIONS: Based on these results, it appears that the combination of TC/CL and TMP/SMX should not be routinely recommended. Macrodilution susceptibility results did predict the activity of TC/CL and TMP/SMX against *S. maltophilia* in this model.

89. Molecular epidemiology of multiple respiratory isolates of *Pseudomonas aeruginosa* in mechanically ventilated patients. Amy T. Calabrese, Pharm.D., *Mary C. Birmingham, Pharm.D.*, Matthew A. Antalek, D.O., Judith M. Hyatt, Pharm.D.; Millard Fillmore Hospital; SUNY at Buffalo, Buffalo, NY.

PURPOSE: To determine whether multiple respiratory isolates of *P. aeruginosa* from mechanically ventilated intensive care unit (ICU) patients have genotypically similar or different strains.
METHODS: All multiple isolates of *P. aeruginosa* from mechanically ventilated patients were evaluated for genotypic and phenotypic variability with pulsed field gel electrophoresis (PFGE) and Etest®, respectively. Patient demographics, antibiotic use, and clinical status were obtained by chart review. Pharmacokinetic/dynamic exposure measures (AUIC, peak/MIC, and percentage time above MIC) were calculated for each antibiotic regimen to determine appropriateness of therapy.
RESULTS: Evaluation of 42 *P. aeruginosa* isolates collected from 16 patients revealed 13 dissimilar strains using PFGE. One strain was similar in four patients. Each patient maintained a similar strain over time. Seven patients, who met pre-determined criteria for pneumonia, were treated for the isolation of *P. aeruginosa*, and five of these were treated multiple times (total of 15 episodes of ventilator-acquired pneumonia [VAP]). Antibiotic therapy was deemed appropriate in nine episodes. Decreased susceptibility of strains over time to piperacillin was consistent with drug exposure.
CONCLUSIONS: Isolation of *P. aeruginosa* in a given patient was not likely due to the background presence or spread of the organism in our ICUs, and the organism tended to persist despite antibiotic therapy. It is unclear, due to small numbers, if the lack of microbiological eradication or clinical improvement in patients with multiple episodes of presumed VAP due to *P. aeruginosa* is attributed to ineffective therapy or to colonization in patients with signs and symptoms consistent with VAP, but due to another etiology.

90. Interleukin-1 upregulates cyclooxygenase-2 expression and prostaglandin E2 production in human trophoblasts: attenuation by nonsteroidal antiinflammatory drugs. *Jessica L. Park, Pharm.D.*, Patty Fan-Havard, Pharm.D., Douglas A. Kniss, Ph.D.; The Ohio State University, Columbus, OH.

PURPOSE: Tumor necrosis factor (TNF-α), a proinflammatory cytokine, is elevated in the amniotic fluid and peripheral blood of pregnant women experiencing infection-related preterm labor. The production of TNF-α in response to an infectious pathogen may promote the release of prostaglandin E_2 (PGE_2) that results in cervical dilation and myometrial contraction. PGE_2 production is catalyzed by cyclooxygenase (COX), which exists as two isoforms. COX-1 is constitutively expressed and involved in normal physiologic activities. COX-2 has been found to be induced during inflammation or cell injury. Limited data exist for interleukin-1β (IL-1β) on the promotion of PGE_2 production from human trophoblast (ED_{27}) cells. In this study, we examined: 1) the effect of IL-1β on COX expression and PGE_2 production, and 2) inhibitory activities between naproxen (NAP) and

nimesulide (NIM), a novel COX-2 specific inhibitor, in ED_{27} cells.
METHODS: ED_{27} cells were incubated in the presence or absence of IL-1β (10 ng/ml) and treated with NAP or NIM (0-10-12M) for 20 hours. Total RNA was extracted and subjected to RT-PCR using specific primer pairs for COX-1 and COX-2. Total protein extracts from ED_{27} were analyzed by Western blots using primary antibodies specific for COX-1 and COX-2. Concentrations of PGE_2 were analyzed by RIA using PGE_2 antibody and $(3H)PGE_2$.
RESULTS: Results of RT-PCR and Western blots confirmed that both COX-1 and COX-2 mRNA and proteins are constitutively expressed in ED_{27} cells. However, IL-1β only promoted COX-2 and not COX-1 expression. The upregulation of COX-2 expression by IL-1β resulted in an approximate 55-fold increase in the biosynthesis of PGE_2 as compared to control. A dose-dependent decrease in PGE_2 production was observed with NAP (IC_{50} ~ 1.9 x 10^{-9}M) and NIM (IC_{50} ~ 1.3 x 10^{-10}M).
CONCLUSIONS: Our results suggest that IL-1β upregulates COX-2 expression with subsequent increase in biosynthesis of PGE_2. In contrast, COX-1 was not upregulated by IL-1β. Treatment with NAP or NIM caused a dose-dependent decrease in the production of PGE_2. In addition, the COX-2 selective inhibitor, NIM, appeared to be more potent in attenuating IL-1β-elicited PGE_2 production.

91. Antibiotic prophylaxis compliance and surgical infections. Christine S. Gawlik, B.Sc.Phm., *Anne Marie Bombassaro, Pharm.D.*, Vivian Leung, Micheal A. John, M.B. ChB., FRCPC; London Health Sciences Centre, London, ON, .

PURPOSE: A committee was established to standardize surgical prophylaxis. Compliance of practice to 1997 Medical Letter (ML) recommendations and the incidence of surgical infection associated with compliance to them was evaluated.
METHODS: Elective surgical admissions to select services from June through August 1998 were prospectively evaluated for compliance to ML with respect to indication, spectrum, timing, and duration of prophylaxis. Post-operative antibiotic prescriptions, hospital readmissions, and infection control records were retrospectively reviewed until October 1998 to identify cases that developed surgical infection.
RESULTS: A total of 225 adult cases were enrolled. No case met strict ML criteria for compliance based on the parameters assessed. When evaluation was modified to include indication, spectrum, and pre-operative dose administration within 2 hours before incision, the compliance was 61% with an infection rate of 1% versus 8% for compliant and noncompliant cases, respectively. Post-operative infection occurred in 6/143 (4%) cases when prophylaxis was required and prescribed versus 1/29 (3%) when it was required but not prescribed, for a total of seven infections. An inappropriate antibiotic spectrum was prescribed in 24/143 (17%) cases with 15/24 related to clindamycin. The spectrum and timing of clindamycin was inappropriate in four of seven cases that developed infection. The incidence of infection was 2% when required prophylaxis was administered within 2 hours before the incision versus 16% when administered prior to 2 hours or after the incision.
CONCLUSIONS: The committee needs to address pre-operative timing and spectrum, indication for prophylaxis in select procedures and a standardized documentation process. Education and surveillance for use of clindamycin in surgical prophylaxis should be instituted.

92. Continuous vs intermittent infusion ceftazidime for the treatment of gram-negative nosocomial pneumonia. *Scott D. Hanes, Pharm.D.*, G. Christopher Wood, Pharm.D., Martin A. Croce, M.D., Timothy C. Fabian, M.D., Elizabeth Pritchard, M.D., Bradley A. Boucher, Pharm.D.; University of Tennessee, Memphis, TN.

PURPOSE: This study compared the clinical and microbiologic outcomes of continuous (CC) vs intermittent ceftazidime (IC) infusion for the treatment of gram-negative nosocomial pneumonia in critically ill trauma patients.
METHODS: Patients were randomized to receive IC 2 g q8h or CC 60 mg/kg/day. Clinical outcome, microbiologic outcome, duration of mechanical ventilation (MV), length of intensive care unit stay, length of hospital stay, and resolution of fever and leukocytosis were compared using parametric tests. The T > MIC was assessed as a pharmacodynamic marker of successful therapy.
RESULTS: The cure rates for IC (n=14) and CC (n=16) therapy were 71% and 56% (p=0.63), respectively. Superinfection occurred in 21% and 47% of all IC and CC patients, respectively, and in 75% and 71% of II and CC treatment failures, respectively. The proportion of patients achieving a normal WBC and temperature during therapy was 50% vs 31% (p=0.50) and 71% vs 50% (p=0.41) for IC vs CC regimens, respectively. For patients with a successful clinical outcome, the duration of MV, length of intensive care unit and hospital stay after excluding two outliers were 13.3 ± 6.1 vs 18.0 ± 14.3 (p=0.36), 15.5 ± 5.9 vs. 20.9 ± 11.2 (p=0.21), and 28.7 ± 15.9 vs 26.7 ± 7.4 days (p=0.76) for IC and CC therapy, respectively. T > MIC was 100% of the dosing interval in all patients except one patient in the IC group.
CONCLUSION: Despite similar pharmacodynamic profiles, CC therapy showed a trend towards an inferior clinical and microbiologic outcome compared to IC.

93. Evaluation of once daily gentamicin dosing in a university hospital setting. *Annika Barrows, Pharm.D.*, David S. Burgess, Pharm.D.; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: It was perceived that once daily aminoglycoside dosing at our institution was being utilized inappropriately based on the antibiotic subcommittee published guidelines. Hence, this study evaluated the use of once daily gentamicin at a university teaching hospital.
METHODS: Patients were identified by a daily report from the department of pharmacy from January-May 1998. Patients were prospectively evaluated and the following information collected: patient demographics, location and service, serum creatinine, length of gentamicin therapy, dosing regimen of gentamicin, serum concentrations drawn, indication for therapy, other antimicrobial therapy, and nephrotoxic agents. Creatinine clearance was calculated using the Cockcroft and Gault method; a rise in serum creatinine more than 0.5 mg/dl was considered nephrotoxic.
RESULTS: A total of 90 patients were evaluated. The age (mean ± SD) was 37.5 ± 16.0 years with 64% being male. The estimated creatinine clearance was 92.2 ± 22.5 ml/min; however, seven (8%) patients had an estimated creatinine clearance less than 60 ml/min. The initial dose of gentamicin was 447 ± 105 mg with 32% of the patients being dosed more than 7 mg/kg based on adjusted dosing weight. The duration of gentamicin therapy was 8.6 ± 14.0 days and 26 (29%) patients received therapy for more than 7 days. Nephrotoxicity was observed in 10/90 (11%). Of the ten patients with nephrotoxicity, seven patients were either treated longer than 7 days, dosed more than 7 mg/kg, and/or had a estimated creatinine clearance less than 60 ml/min.
CONCLUSION: Only 48% of the patients receiving once daily gentamicin were considered appropriate based on our institution's antibiotic subcommittee guidelines. Additional educational efforts are being undertaken to improve the appropriate use of once daily aminoglycosides at our institution.

94. Are there differences in the treatment of community-acquired pneumonia between a community and university hospital? *Donna R. Burgess, B.S.*, David S. Burgess, Pharm.D., Nish Patel, Pharm.D.; St. Luke's Baptist Hospital; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: To compare the treatment of hospitalized patients with community-acquired pneumonia at a community and a university hospital by risk stratification according to a validated prediction model (N Eng J Med 1997;336:243-50).
METHODS: All patients admitted to a community and a university hospital for one year with an ICD-9 diagnosis of 486 (pneumonia with no organism specified) were evaluated retrospectively. The following information was collected: patient demographics, coexisting illnesses, length of hospital and intensive care unit stay, antibiotic regimen and length of therapy, laboratory measurements, physical examination and radiographic findings, and mortality. Patients were assigned a risk class as described by Fine, et al. Categorical variables were compared using chi squared or Fisher's exact test and continuous variables were compared using the Mann Whitney U test.
RESULTS: A total of 127 and 187 patients were evaluated for the community and university hospital groups, respectively, and stratified into risk classes as follows.

	I	II	III	IV	V
Percentage of patients					
Community	8%	13%	24%	37%	18%
University	19%	32%	22%	21%	5%
Age (years)					
Community	39.7 ± 7.3	65.1 ± 11.4	70.5 ± 12.5	78.3 ± 10.3	81.8 ± 10.0
University	36.7 ± 8.4	48.9 ± 14.4	57.5 ± 17.2	60.8 ± 17.3	64.3 ± 11.6
Length of stay (days)					
Community	4.5 ± 2.2	4.1 ± 1.0	5.1 ± 2.3	5.0 ± 2.4	4.5 ± 2.2
University	6.6 ± 4.3	5.1 ± 2.4	6.2 ± 5.4	8.1 ± 5.0	9.6 ± 5.3

Differences do not exist between the institutions with regard to mortality or intensive care unit admission; however, significant differences do exist in severity of illness, age, length of stay, and length of IV antibiotic therapy.
CONCLUSION: Patients with community-acquired pneumonia were sicker (based on the prediction rule), older, and had a shorter length of stay at a community hospital than a university hospital.

95. Assessment of the American Thoracic Society guidelines for hospitalized patients with community-acquired pneumonia. *Nish Patel, Pharm.D.*, David S. Burgess, Pharm.D., Donna R. Burgess, B.S.; St. Luke's Baptist Hospital; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: To compare the prescribed empiric antibiotic therapy and medical outcomes in patients treated consistently and inconsistently with the American Thoracic Society (ATS) guidelines (Am Rev Respir Dis 1993;148:1418-26) for hospitalized patients with community-acquired pneumonia.

METHODS: All patients admitted over a 1-year period to a community and university hospital with an ICD-9 primary diagnosis of 486 (pneumonia with no organism specified) were evaluated. Patients with HIV/AIDS, discharged from the hospital within 7 days, or transferred from another hospital were excluded. The following information was collected from each medical chart: patient demographics, coexisting illnesses, length of hospital and intensive care unit stay, antibiotic, length of antibiotic therapy, and mortality. Antibiotic regimens initiated on the day of admission were compared to the ATS guidelines. Variables were compared using chi squared, Fisher's exact, or the Mann-Whitney U test.
RESULTS: A total of 314 patients were evaluated (187 from university hospital and 127 from community hospital). Overall, 80% of the patients were treated consistently with ATS guidelines without any difference between the institutions. The most common antibiotics were a nonpseudomonal third generation cephalosporin with a macrolide (45%), a nonpseudomonal third generation cephalosporin alone (36%), and a nonpseudomonal third generation cephalosporin in combination with another agent (8%). Although the length of stay was shorter for those patients treated consistently with the ATS guidelines (6.7 ± 4.5 vs 5.6 ± 3.6), it was not statistically significant. However, statistical differences do exist in mortality between patients treated consistently vs inconsistently with the ATS guidelines (3% vs 16%; p=0.0006).
CONCLUSION: The use of ATS guidelines for the treatment of hospitalized patients with community-acquired pneumonia demonstrated a decrease in mortality. A prospective clinical study needs to be performed utilizing ATS guidelines to validate these findings.

96. Comparison of in vitro activity of voriconazole, SCH-56592, and fluconazole against *Candida albicans* by time-kill methodology. David S. Burgess, Pharm.D., *Auris Huen, Pharm.D. candidate*, Rhonda W. Hastings, Pharm.D.; University of Texas at Austin, Austin, TX; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: Voriconazole and SCH-56592 are two new triazoles currently under investigation for the treatment of systemic fungal infections. The purpose of this study was to evaluate the in vitro activity of voriconazole, SCH-56592, and fluconazole against three clinical isolates of *C. albicans* using time-kill methodology.
METHODS: In vitro susceptibility testing was performed by broth microdilution following NCCLS guidelines (M27-A). MICs were read as the well in which an 80% reduction in fungal growth was observed at 48 hours. Time-kill studies were performed in RPMI 1640 buffered with MOPS at eight drug concentrations ranging from 0.25 to 32 x MIC and initial inocula of [a] 10^5 CFU/ml. At 0, 4, 8, 12, 24, 36, and 48 hours, aliquots were removed, serially diluted, and plated onto Sabouraud dextrose agar using a spiral plater. Colony counts were determined following incubation for 24 hours at 35∞C. Plots of colony count versus time were constructed.
RESULTS: The MICs (µg/ml) at 48 hours were:

Organism	Fluconazole	Voriconazole	SCH-56592
C. albicans 98-1262	16	1	0.25
C. albicans 98-1518	4	0.03	0.06
C. albicans 98-1329	2	0.0078	0.03

The growth curves for *C. albicans* 98-1262, when treated with each of the antifungals, resembled that of the growth control. However, at the voriconazole concentration of 32 x MIC, growth was suppressed for 48 hours. On the other hand, for *C. albicans* 98-1518, each of the antifungals suppressed growth for the initial 24 hours. This suppression was maintained for 48 hours only by SCH 56592 at the concentration of 32 x MIC. For *C. albicans* 98-1329, slight inhibition was observed irrespective of the antifungal agent or concentration.
CONCLUSION: The in vitro activity of two investigational triazoles, voriconazole and SCH-56592, against three clinical isolates of *C. albicans* was similar to fluconazole.

Nephrology

97. Implementation of single daily dose aminoglycosides to reduce the incidence of nephrotoxicity in critically ill patients. *Rudina M. Odeh-Ramadan, Pharm.D.*, Cesar Alaniz, Pharm.D., Stacey Hayes, Pharm.D. candidate; University of Michigan Health System, Ann Arbor, MI.

PURPOSE: A single daily dose aminoglycoside protocol to reduce the incidence of nephrotoxicity related to improper dosing of aminoglycosides will be described. The use of a single daily dose dosing protocol was implemented in all applicable patients being treated with aminoglycoside antibiotics in the intensive care units (ICUs).
METHODS: A dosing card was developed and distributed to guide physicians in calculating the patient's ideal body weight, creatinine clearance, and appropriate aminoglycoside dose. The health care professionals involved in the treatment of patients in the indicated ICUs were inserviced as to the purpose and goals of the dosing protocol. Physician education was also conducted on a routine basis. A computer report was generated on a daily basis by the department of pharmacy, indicating the patients in whom aminoglycosides were ordered. This report was reviewed daily by a clinical pharmacist to identify patients in whom a new aminoglycoside order was entered. A formal pharmacokinetic consult was then conducted by a clinical pharmacist to evaluate the patient's dosing regimen and kinetic parameters. Each patient was then followed on a daily basis. Pharmacokinetic parameters assessed included serum creatinine, BUN, albumin, daily weight, concomitant nephrotoxic agents, and aminoglycoside serum concentrations (2-hour and 12-hour post dose).
RESULTS: A substantial decrease in aminoglycoside-associated nephrotoxicity (16%) was observed compared to the control group (26%). Of all patients treated, 86.5% received single daily dose aminoglycoside therapy compared to the control group (47.5%).

98. Pharmacokinetics of intravenous cefazolin in hemodialysis patients. Kamani Gopalakrishna, B.S., *Chai L. Low, Pharm.D.*, Wai C. Lye, M.D.; National University of Singapore; National University Hospital, Singapore.

PURPOSE: To determine the pharmacokinetics of intravenous cefazolin in hemodialysis patients.
METHODS: Ten volunteer hemodialysis patients without history of penicillin or cephalosporin allergies were recruited for the study. Seven patients were dialyzed twice weekly and three were dialyzed thrice weekly. Two patients were anuric. All patients received 1 g of cefazolin sodium IV over 20 minutes at the start of a 4-hour hemodialysis session, using high-flux cellulose dialyzer membrane (CF23). Blood samples were taken at 0, 0.5, 1, and 2 hours, at the end of hemodialysis, and just before the next hemodialysis session began. A validated HPLC assay was used to determine cefazolin levels in plasma.
RESULTS: The pharmacokinetic parameters determined were:

	$t_{1/2-1}$ (hr)	$t_{1/2-2}$ (hr)	Cl_t (ml/min)	Cl_d (ml/min)	Cl_i (ml/min)
Mean	2.5	46.1	63.3	59.9	3.4
SD	1.3	19.7	23.7	24.5	1.6

$t_{1/2-1}$ is the half-life of drug during dialysis; $t_{1/2-2}$ is the half-life of drug off dialysis; Cl_t, Cl_d, Cl_i are total, dialyzer, and intrinsic clearances, respectively

Dialysate and blood flow rates were 500 ml/min and 275 ± 86 ml/min, respectively. Initial plasma concentrations (177.6 ± 53.1 µg/ml) fell by 65% to 61.9 ± 29.4 µg/ml at the end of 4 hours of hemodialysis. Plasma concentrations just before the next hemodialysis for patients undergoing thrice and twice weekly dialysis were 31.0 ± 7.4 and 17.0 ± 6.2 µg/ml, respectively. These were levels which exceeded the MICs (< 5 µg/ml) of susceptible organisms.
CONCLUSIONS: A once weekly IV dose of 1g of cefazolin will maintain therapeutic concentrations in patients undergoing thrice or twice weekly 4-hour hemodialysis sessions, using high-flux cellulose dialyzer membranes.

99. Validation of a vancomycin dosing protocol for patients receiving high-flux hemodialysis. *Omaira Meléndez, Pharm.D.*, Naomi V. Dahl, Pharm.D., Ankit Patel, Toros Kapoian, M.D., Richard A. Sherman, M.D., Edward F. Foote, Pharm.D., BCPS; Rutgers, The State University of New Jersey, Piscataway, NJ; UMDNJ-Robert Wood Johnson Medical School, New Brunswick, NJ; DCI/RWJ Dialysis Center, North Brunswick, NJ.

BACKGROUND AND PURPOSE: Unlike conventional hemodialysis, high-flux hemodialysis (HFHD) removes significant amounts of vancomycin. For this reason, vancomycin is often administered after HFHD, which causes significant patient inconvenience, scheduling difficulties, and increased cost. Following a pilot study (Clin Neph 1998;50:51-5), we have utilized a protocol in which we give high dose vancomycin during HFHD to offset intradialytic loss. The purpose of this study was to validate this protocol in the clinical setting.
METHODS: Patients were given 25 mg/kg vancomycin load, then 20 mg/kg every other or every third (weekly) HD session. Administration of the dose was timed so that 1 gram/hr was given to coincide with the end of dialysis. Vancomycin trough levels were drawn pre-HD and assayed by FPIA.
RESULTS: Fifteen infected, anuric (7) and non-anuric (8) patients on thrice weekly HFHD (Fresenius F-80) received 68 doses according to protocol between February 10 and October 29, 1998. In these patients, 34 trough levels were obtained. Mean trough levels (mg/L) after loading and maintenance doses were as follows.

	Every Other HD Dosing	Every Week Dosing
Loading dose	7.47 ± 1.86 (range 5.4-9.0)	7.32 ± 3.35 (range 2.8-11.2)
Maintenance dose	14.87 ± 6.58 (range 5-26)	9.78 ± 4.92 (range 5.8-19.5)

CONCLUSION: The relative high variability in trough concentrations could not be explained by factors such as residual urine output. Since trough concentrations after the loading doses were somewhat lower than maintenance doses, a higher loading dose (30 mg/kg) may be required. Early concentration monitoring and individualization of dosing is recommended.

100. Ceftazidime clearance in septic and non-septic rats receiving continuous arteriovenous hemofiltration. Khalid AlKharfy, Pharm.D., *Gary*

R. Matzke, Pharm.D., FCP, FCCP, Reginald F. Frye, Pharm.D., Ph.D., John A. Kellum, M.D.; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: This investigation was designed to assess the disposition of ceftazidime (CTZ) in a rat model of intraabdominal sepsis, cecal ligation/puncture (CLP). The clearance of CTZ by continuous arteriovenous hemofiltration (CAVH) was also assessed, as well as the cytokine (IL-6) response to CLP and CTZ.
METHODS: Six adult Sprague-Dawley rats underwent CLP and five underwent a sham surgical procedure (SHAM). Fourteen hours after surgery, CAVH with an AN69 minifilter (Miniflow®, Hospal, France), was started and a 30 mg/kg bolus dose of CTZ was given. Multiple blood samples (n=9) were collected over the next 6 hours. Total ultrafiltrate was collected in nine intervals during CAVH. Total body clearance (CLp), CAVH clearance (CLCA), volume of distribution (Vd), and the half-life ($t_{1/2}$) of CTZ were calculated. Concentrations of IL-6 and CTZ were determined by ELISA and HPLC.
RESULTS: The disposition of CTZ in the CLP and sham groups were similar ($p>0.05$): CLp 10.194 ± 0.05 L/kg/hr vs 0.175 ± 0.05 L/kg/hr; Vd 0.17 ± 0.05 L/kg vs 0.16 ± 0.04 L/kg; $t_{1/2}$ 1.5 ± 0.4 vs 1.4 ± 0.4 hours. The mean CLCA and the sieving coefficient (SC) of CTZ by the AN69 filter were 0.040 ± 0.007 L/kg/hr and 1.0 ± 0.1, respectively. IL-6 levels increased significantly (more than 60-fold) within 6 hours after CTZ administration.
CONCLUSION: These data indicate that the disposition of CTZ is unchanged in the presence of intraabdominal sepsis and thereby collaborates with previous observation in humans (Antimicrob Agents Chemother 1998;32:1845-7). The SC of the Miniflow® AN 69 filter (SA=0.042 m^2) was similar to our previous observation with the Multiflow 60-AN69 (SA=0.63 m^2) filter in human. Thus, this animal model may be useful to predict drug disposition and CAVH clearance in the presence of systemic infection.

101. Cefazolin pharmacokinetics in hemodialysis patients. Darren W. Grabe, Pharm.D., Michael A. Marx, Pharm.D., Bruce A. Mueller, Pharm.D., *Harold J. Manley, Pharm.D.*, George R. Bailie, Pharm.D., Ph.D.; Albany College of Pharmacy, Albany, NY; University of Arkansas, Little Rock, AR; Purdue University, West Lafayette, IN.

PURPOSE: Concern about the indiscriminate use of vancomycin has lead to an increased use of cefazolin. Studies of cefazolin pharmacokinetics using contemporary hemodialysis membranes and techniques have not been done. The purpose of this study was to characterize the pharmacokinetics of cefazolin in conventional (CHD), high-efficiency (HEHD), and high-flux hemodialysis (HFHD).
METHODS: In an open-label, nonrandomized, multicenter trial, uninfected hemodialysis patients received a single, intravenous, bolus dose of 15 mg/kg (dry weight) of cefazolin at the end of a routine dialysis session. Blood and urine, if any, samples were collected over the interdialytic period and during the next dialysis treatment. Samples were assayed for cefazolin by high performance liquid chromatography. Pharmacokinetic parameters were calculated and compared for the different types of hemodialysis.
RESULTS: A significant difference was found between the dialysis clearance of HFHD and HEHD. In addition, there was a significant difference in the dialysis clearance between HFHD and CHD. There was no difference in the dialysis clearance between HEHD and CHD. Patients who were nonanuric had significantly shorter elimination half-lives. There was modest cefazolin rebound in all groups.
CONCLUSIONS: This study is the first to compare the clearance of cefazolin during hemodialysis using different dialysis conditions. HFHD had significantly higher clearances than either of the two other hemodialysis conditions.

102. The impact of undergraduate pharmacy student interventions in hemodialysis outpatients. *Harold J. Manley, Pharm.D.*, Darren W. Grabe, Pharm.D., George R. Bailie, Pharm.D., Ph.D.; Albany College of Pharmacy, Albany, NY.

PURPOSE: The early patient-oriented care (EPOC) program was designed to provide clinical experience to undergraduate students and enhance their didactic training. In the program, students made interventions from identified drug-related problems (DRPs). We report the interventions outcomes made by EPOC students over three semesters.
METHODS: Eleven EPOC students were each assigned 12-15 hemodialysis (HD) patients to visit monthly under preceptor supervision. They obtained medication histories, reviewed pertinent records, and communicated with other professionals about the patients. Individual patients were discussed with preceptors and DRPs identified. Recommendations were made to physicians based on the DRPs and, if accepted in whole or in part, were deemed an intervention. Significance and perceived impact of interventions were determined. Intervention outcomes were later documented.
RESULTS: Students identified 210 DRPs over 39 weeks in 145 HD patients. Recommendations were made in 186 (88.6%) identified DRPs and 130 (69.9%) were deemed interventions. Interventions were followed in whole 78.5% of time, or in part 21.5% of time. Intervention outcomes led to positive patient or laboratory response 32.3% of the time, or to efficient patient management or inappropriate order eliminated 36.9% of the time. Interventions were predominately for anemia management (44.6%), renal bone disease (26.9%), and cardiac issues (9.2%). Significant ranks of interventions made were: 5.3% not significant; 10% somewhat significant, 73.1% significant, and 11.5% very significant. Interventions impacted cost (20.8%), care (21.5%), both cost and care (53.1%), or neither cost nor care (4.6%).
CONCLUSION: EPOC students provided a valuable service to HD patients. This teaching method has expanded to other patient populations.

103E. Vancomycin removal during hemodialysis: a comparison between polysulfone and cuprophan membranes. *Thomas J. Comstock, Pharm.D.*, George M. Feldman, M.D., Tina S. Stacy, Pharm.D., Ann D. Compton, M.S.N.; Virginia Commonwealth University, Richmond, VA.

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104E. Pharmacokinetic model for drug disposition during hemodialysis: use of in vitro and in vivo data. *Joanna Q. Hudson, Pharm.D.*, Thomas J. Comstock, Pharm.D., George M. Feldman, M.D.; University of Tennessee, Memphis, TN; Virginia Commonwealth University, Richmond, VA.

J Am Soc Nephrol 1998;9:173A.

105E. Safety and dialyzability of gadobenate dimeglumione in hemodialysis patients. *Thomas J. Comstock, Pharm.D.*, Joanna Q. Hudson, Pharm.D., Antonio A. Pedro, M.D., Domenic A. Sica, M.D., Brian E. Davies, Ph.D.; Virginia Commonwealth University, Richmond, VA; University of Tennessee, Memphis, TN; Bracco Diagnostics.

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Neurology

106. Efficacy of sustained release bupropion in neuropathic pain: an open-label study. *Marilyn R. Semenchuk, Pharm.D., BCPP*, Bennet E. Davis, M.D.; University of Arizona, Tucson, AZ.

PURPOSE: To assess the efficacy and tolerability of sustained release bupropion (SR) in neuropathic pain. Although tricyclic antidepressants (TCAs) relieve neuropathic pain, some patients fail to respond or have unacceptable side effects. Bupropion, a nontricyclic antidepressant that blocks reuptake of both norepinephrine and dopamine, can often be tolerated well in those who experience problems with the TCAs. It may also be effective in neuropathic pain.
METHODS: In an open-label study, 22 patients with neuropathic pain received 1 week of bupropion SR 150 mg once daily, followed by 7 weeks of bupropion SR 150 mg twice daily. Treatment effects were assessed by daily ratings of pain intensity, post-treatment global ratings of pain relief, depression scores (Hamilton Depression Scale), and daily ratings of side effects.
RESULTS: Fifteen patients (68%) reported their pain relief was improved or much improved with bupropion. The mean average pain score at week 1 was 6.7, which decreased at the end of week 8 to 3.8 (paired t-test, $t[df=14] = 3.754$; $p=0.002$) in the patients who improved. Pain relief was statistically significant at week 5 (paired t-test, $t[df=21] = 3.816$; $p=0.001$) and continued throughout weeks 6, 7, and 8. Most patients were not depressed and analgesia was observed to occur without a change in depression ratings in the majority of patients who responded. Side effects were rated as mild and consisted primarily of insomnia (eight patients), tremor (three patients), and gastrointestinal upset (two patients). These symptoms had a tendency to recede with continuation of therapy.
CONCLUSIONS: We conclude that bupropion may be an effective treatment for neuropathic pain in many patients and is well tolerated, offering an alternative for patients unable to tolerate other medications. Blockade of norepinephrine reuptake may mediate this effect. The role of dopamine reuptake blockade is uncertain. A larger randomized, double-blind, placebo-controlled study is currently underway to support or refute the positive preliminary findings of bupropion's efficacy and safety in neuropathic pain.

Nutrition

107. The Connecticut Hills ginseng study summary report. *Rolf Martin, Ph.D.*; HR Herbs, Sherman, CT.

PURPOSE: The objectives of this 3-phase, placebo-controlled crossover study were to determine whether American and Korean ginseng improve mental sharpness, mood, aches, stress, morning and evening energy, and simple and complex reaction times.
METHODS: Thirty-five participants received either ginseng or placebo (brown rice powder) for 12 weeks while response times were measured and daily self-reports were prepared. During phase I of the study, participants received either placebo or American ginseng powder provided by Pickrell's Ginseng Farm (Kentucky). During phase II, participants received placebo or Royal King Red Korean ginseng extract from 9-Star Ginseng Products

(Vermont). And during phase III, participants received placebo or 6-year Korean ginseng powder from Hsu's Ginseng Enterprises (Wisconsin).
RESULTS: Fifty-five thousand measurements were obtained, providing a detailed view both of the level of benefits and day-by-day changes in each. American and Korean ginseng each improved self-reported sharpness, aches, mood, and energy by approximately 10% (unpaired Student's t-test p=0.003). Stress was not reduced. Improvement occurred within 1 week and disappeared within 1 week when ginseng was replaced by placebo. Benefits also declined to baseline after 2 weeks while American ginseng was consumed. Sleep quality did not change significantly. Reaction speeds improved and then held steady when ginseng was administered, slowed by 9.5% when placebo was consumed, and increased once again when ginseng was consumed (p=0.05). Gender and age had no effect on the amount of benefit. The complete study database is accessible via the Internet at http://members.tripod.com/~responsetime/database.htm.
CONCLUSIONS: Three kinds of ginseng provided a variety of benefits within 1 week of consumption.

108. Suspected microbial contaminations in TPN solutions: an assessment over four years. *I.M. Chauveau*, S.A. Mairesse, S.M. Provot, P.M. Meunier; Children University Hospital, Tours, France.

The Department of Pharmacy of Children's Hospital prepares daily TPN solution bags. On Fridays, three bags are prepared per child to last through the weekend. Every bag undergoes a microbiologic control. As a few contaminations did occur, a follow-up procedure was set up in 1994. The aim of our study is to assess all suspected contaminations over a 4-year period. On receipt of a positive microbiologic test, the pharmacist and the prescriber take the necessary measures for each of the three following possible cases. 1) When the TPN bag has not already been perfused, the bag is withdrawn and controlled again. 2) When the bag is being perfused, the perfusion is either stopped and the bag controlled, or continued, which leads to the third scenario. 3) When the bag has been perfused, any bag contamination checking is then impossible. Depending on the isolated organism, the pharmacist checks the accurate implementation of current procedures in the preparation area. Of 8434 TPN bags prepared during the study period, 39 bags (0.46%) were suspected of microbial contamination. Two bags were not perfused, four bags were partially perfused, and 33 bags had already been perfused. Only two bags were withdrawn and showed negative microbiologic tests. In one case, the isolated organism, *S. epidermidis*, was identified in the patient's hemoculture, which implied possible contamination through the TPN infusion.
This procedure cannot be extended over limits. The workload is responsible for the fact that most contaminations occur on Fridays (57% of cases). As microbiologic test results are not available before Mondays, TPN bags have been perfused and cannot be controlled again. Following the withdrawal of the two bags and their negative results, the infection control protocols were revised. The setting up of a sample collection is envisaged to allow the verification of first results. Ideally, the Friday preparation session should be lightened by an additional Saturday session.

109. Tolerance of a standard intravenous hyperalimentation solution in low birthweight infants. *T.A. Tran, M.D.*, G. Piriou, P.D., S. Thirion, M.D., J. Sizun, M.D., C. Pitre, P.D., J.L. Saubion, P.D., N. Borgnis Desbordes, P.D., L. De Parscau, Ph.D.; Brest University Hospital, Brest Cedex, France; Libourne Hospital, France.

Hyperalimentation is known to improve growth in low birthweight infants (LBWI). To optimize LBWI growth, we elaborated an industrial standard intravenous hyperalimentation solution (SHIS) named TPS29.
PURPOSE: This is a retrospective analysis of TPS29 tolerance.
METHODS: All newborns 30 weeks or less gestational age over a 1-year period were included. TPS29 100 ml includes: glucose 12.85 g, amino acids 2.14 g, Na and K 2.14 mM, Cl and P 1.43 mM, Ca 1.07 mM, and Mg 0.22 mM. Daily vitamins and lipids (3 g/kg/d) are given separately. TPS29 is usually started at day 3 with 100 ml/kg/d and increased by 10 ml/kg/d up to 155 ml/kg/d. Enteral nutrition is started as soon as possible.
RESULTS: Thirty-six babies were included. Gestational age was 28.4 ± 1.4 weeks; birth weight was 1100 ± 297 g; 16.7% were small for their age, and 8.3% had necrotizing enterocolitis. Intravenous feeding duration was 24 ± 20.6 days; exclusive intravenous feeding was for 16.75 ± 16.8 days. Caloric intake was 106.5 ± 8.7 Kcal/kg/d and protein intake was 2.5 ± 0.75 g/kg/d. Tolerance included metabolic acidosis, 0%; electrolytes supplementation, 4%; insulin use for hyperglycemia, 0.8%; and personalized nutrition needs, 10% (for fluid restriction, essentially).
CONCLUSION: TPS29 in LBWI seems to be safe. A prospective study is in progress to access its efficiency and to confirm good tolerance.

Oncology

110. Pharmacy support for the prophylaxis of oral mucositis induced by 5-fluorouracil-based chemotherapy. *F.S. Robustelli della Cuna*, A.M. Goglio, A.M. Cuomo, F. Fiore, G. Ucci; Fondazione S. Maugeri, Pavia, Italy; General Hospital, Mortara, Italy.

PURPOSE: Investigation of the efficacy of a low-cost galenic formulation to prevent oral mucositis (OM) in patients undergoing 5-fluorouracil (FU)-based chemotherapy.
METHODS: Twenty-four patients with metastatic breast and colon cancer undergoing infusional FU alone (1000 mg/m^2/96h [n=14]), or the same infusion plus vinorelbine (20 mg/m^2 on days 1 and 6 [n=10]) used a mouthwash solution (MWS) for days 7-14. The MWS, given 4 times per day, consisted of nystatin (10^6 IU) and lidocaine (100 mg). On demand, 3 times per day, patients also received jelly-like candies containing 6 of mg tetracaine. OM was scored by a modification of the Spijkervet Index and quality of life (QOL) was evaluated by WHO criteria for 138 administered cycles. A retrospective comparison for incidence and grade of toxicity was made with 28 patients with metastatic breast cancer who underwent 152 infusions of the FU and vinorelbine regimen and received allopurinol mouthwashes using the same time schedule.
RESULTS: Overall, the OM distribution by grade of severity was:

	n	Grade (Day 7; %)		Grade (Day 14; %)	
		0 + 1	2 + 3	0 + 1	2 + 3
Present series	24	17 (71)	7 (29)	23 (96)	1 (4)
Historical controls	28	19 (68)	9 (32)	20 (71)	8 (28)

The total QOL scores for patients receiving the galenic MWS was significantly (Wilcoxon test) improved after seven days of prophylaxis.
CONCLUSIONS: Our galenic MWS resulted in effective prevention of OM induced by chemotherapy. Further confirmatory prospective randomized comparisons with other mouth rinses seem warranted.

111. Clinical significance of NAD(P)H: quinone oxidoreductase bp 609 polymorphism in patients with malignant ascites receiving intraperitoneal hyperthermic mitomycin C perfusion. *Ronald A. Fleming, Pharm.D.*, Jeffrey Drees, B.S., Brian W. Loggie, M.D., Gregory B. Russell, M.S., Kim R. Geisinger, M.D.; Wake Forest University, Winston-Salem, NC.

PURPOSE: NAD(P)H: quinone oxidoreductase (NQO1) activity positively correlates with mitomycin C (MMC) cytotoxicity in vitro. A point mutation at the bp 609 position in exon 6 results in reduced NQO1 activity and resistance to MMC in vitro. The purpose of this study was to determine the frequency and clinical significance of this mutation in patients with malignant ascites receiving intraperitoneal hyperthermic perfusion with mitomycin C.
METHODS: Patients with malignant ascites underwent aggressive cytoreductive surgery and a 2-hour heated (40.5°C) perfusion with MMC (40 mg). Genomic DNA was isolated from patients and a PCR-RFLP method used to detect the presence of the bp 609 mutation. Estimates of the survival function over time were determined using the Kaplan-Meier method. Group comparisons of survival data were performed by the log rank test.
RESULTS: Twenty-two patients were eligible for survival analysis (median age 47 years old, range 24-72; 13 males, 9 females). Primary disease sites included appendix (5), colon (5), stomach (4), other gastrointestinal (2), and non-gastrointestinal sites (6). The number of wild-type, heterozygous, and homozygous mutant genotypes for the bp 609 mutation were 16, 6, and 0, respectively. The median survival of patients with wild-type versus heterozygous genotype was 12.3 vs 4.2 months (p=0.17). The percentage of patients surviving 6 months in the wild-type versus heterozygous genotype group was 75 and 33%, respectively (p=0.06).
CONCLUSIONS: These preliminary data suggest that the presence of the NQO1 bp 609 mutation may result in a shorter survival than patients without this mutation following intraperitoneal MMC administration.

112. Safety and efficacy of once daily aminoglycoside therapy in febrile neutropenic cancer patients. *Theodore G. Barlows, III, Pharm.D.*, Bridget J. Bernstein, Pharm.D., Venessa S. Price, Pharm.D., Lourdes M. Blanchard, Pharm.D.; Nova Southeastern University; Baptist Hospital of Miami, Miami, FL.

PURPOSE: To evaluate the safety and efficacy of once-daily aminoglycosides (ODA) in febrile neutropenic cancer patients.
METHODS: We retrospectively reviewed 100 consecutive patients who received ODA from January 1995 to November 1996. Empiric antibiotic therapy consisted of a β-lactam and 7 mg/kg of gentamicin. Demographic data as well as temperature, creatinine, WBC, absolute neutrophil count, dose, dosing interval, duration of therapy, length of stay, concomitant medications, and microbiology results were documented. Nephrotoxicity was defined as a rise in serum creatinine of more than 0.5 mg/dl above baseline. Ototoxicity was identified by documentation in the medical record. In patients with positive microbiologic findings, clinical response was defined as resolution of clinical signs and symptoms of infection.
RESULTS: Median age was 59 (range 27-86) years. There were 63 females and 37 males. The median WBC nadir was 600 (range 100-85,500) cells/mm^3, and median T_{max} was 38.5 (range 37-42) degrees Celsius. The median dose was 450 (range 300-620) mg, while the median length of gentamicin therapy was 4 (range 1-40) days. Eighty-four percent of patients received gentamicin every 24 hours, with 9% and 6% receiving the drug every 36 and 48 hours, respectively. One patient required greater than 48-hour dosing. No patients experienced ototoxicity, with a median follow-up period of 3 (range 1-23) days. Four patients (4%) experienced nephrotoxicity secondary to

multisystem organ failure not attributed to ODA therapy. Thirty patients had positive microbiologic findings, and of those, 77% demonstrated clinical response. Furthermore, 85% of all patients evaluated were discharged and considered clinically improved.
CONCLUSION: The data presented suggest that ODA therapy is safe and effective in the febrile neutropenic patient population.

113. New insights into the pharmacokinetics and metabolism of (R,S)-ifosfamide in cancer patients using a population pharmacokinetic-metabolism model. Marika Pasternyk Di Marco, M.S., Irving W. Wainer, Ph.D., Camille L. Granvil, M.S., Gerald Batist, M.D., *Murray P. Ducharme, Pharm.D.*; Université de Montréal, Montréal, PQ, Canada; Georgetown University Medical Center, Washington, DC; McGill University, Montréal, PQ, Canada.

PURPOSE: The aim of this study was to develop a population pharmacokinetic-metabolism (PK-MB) model to simultaneously explain plasma and urine concentrations of (R)- and (S)-ifosfamide (IFF), and the respective 2 and 3 N-dechloroethylated metabolites (R2-, R3-, S2-, S3-DCE-IFF).
METHOD: (R,S)-IFF was administered (1.5 g/m^2) daily for 5 days in 11 cancer patients. Plasma and urine samples were collected and analyzed using an enantioselective GC-MS method. An average of 97 observations per patient were simultaneously fitted using an enantioselective PK-MB model with induction process. The population analysis was performed using an iterative 2-stage method (IT2S). Discrimination between candidate PK-MB models was performed by visually inspecting graphs, and by computing the Akaike information criterion test.
RESULTS: The formation of DCE metabolites were induced over the 5-day period. IFF clearance increased (R: 4 vs 7.5 L/h; S: 5 vs 10 L/h), formation to DCE metabolites increased (R: 10 vs 13%; S: 16 vs 18%), and the active metabolites (4-OH) remained constant (R: 66 vs 67%; S: 64 vs 64%). While metabolic induction was observed, a novel finding of this analysis was that renal excretion of DCE metabolites was also induced. One explanation for these results is upregulation of P-glycoprotein activity during IFF treatment.
CONCLUSION: This population PK-MB model for (R,S)-IFF may be useful in optimizing patient care, and gives new insight in (R,S)-IFF metabolism.

Pediatrics

114. The pharmacokinetics of busulphan in pediatric bone marrow transplantation. Wendy Pinel, M.S., *Andrzej J. Kostrzewski, M.S., M.Med.Ed.*, Soraya Dhillon, Ph.D.; University of London; Guy's & St. Thomas' Hospital Trust, London, United Kingdom.

PURPOSE: Oral busulphan is implicated in hepatic veno-occlusive disease (HVOD) and is used in the pre-conditioning regimen for bone marrow transplantation (BMT). This study describes the pharmacokinetic (PK) profile of oral busulphan in pediatric patients with and without HVOD after BMT.
METHODS: Data were reviewed from 44 patients between May 1992 and August 1996. All patients were treated with allopurinol 4 mg/kg for 5 days, overlapping with Campath", a monoclonal antibody, for 5 days. Busulphan was started 10 days before marrow harvest. All patients received 2 mg/kg or 2.5 mg/kg every 12 hours for 4 days. Doses were crushed and administered by nasogastric tubes and tubes were irrigated after each dose. Venous blood samples were taken at 0, 30, 60, 90, 120, 240, and 420 minute intervals. Busulphan concentrations were measured in whole blood by gas liquid chromatograph. The PK parameters were determined by MW\PHARM‰ (Mediware BV Universit of Croningen) and the incidence of HVOD using the McDonald criteria.
RESULTS: The median age was 3.2 years (range 3 months to 16 years); 30 male and 14 female. Eight patients (18%) suffered from HVOD with four deaths as a consequence. Comparison of the mean ± SD PK parameters were:

	HVOD n=8	non-HVOD n=36	p value (t-test)
AUC (µM•hr/L)	40.4 ± 14	32.43 ± 6	0.12
Cl/kg (L/kg/hr)	0.23 ± 0.11	0.28 ± 0.03	0.53
Vd (L/kg)	0.74 ± 0.21	0.83 ± 0.01	0.48
Elim $t_{1/2}$ (hr^{-1})	2.28 ± 0.47	2.11 ± 0.28	0.53
Time to peak (hr)	1.01 ± 0.66	0.83 ± 0.11	0.40
Peak conc (µM/L)	10.3 ± 3.68	9.09 ± 2.16	0.37

CONCLUSIONS: There was no significant difference between the mean PK values, but there was a trend for a higher AUC displayed between HVOD and non-HVOD sufferers. More data is needed to investigate HVOD and the AUC of busulphan.

115E. Albuterol delivery in a neonatal ventilator-lung model. *Ralph A. Lugo, Pharm.D.*, Julie K. Kenney, Pharm.D., Jim Keenan, B.S., RRT, John W. Salyer, B.S., RRT, Julie Ballard, B.S., RRT, Robert M. Ward, M.D.; Primary Children's Medical Center; University of Utah, Salt Lake City, UT.

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116E. Performance comparison of four spacers in a neonatal mechanical ventilator-lung model. Jim Keenan, B.S., RRT, *Ralph A. Lugo, Pharm.D.*, John W. Salyer, B.S., RRT, Robert M. Ward, M.D.; University of Utah; Primary Children's Medical Center, Salt Lake City, UT.

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117E. Cisatracurium infusion in infants 0-2 years in a pediatric intensive care unit: an open-labeled study. *Varsha Bhatt-Mehta, Pharm.D.*, Frank W. Moler, M.D., Joseph R. Custer, M.D., Norma J. Maxvold, M.D., Jihad J. Zahraa, M.D., Folafoluwa Odetola, M.D.; University of Michigan, Ann Arbor, MI.

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Pharmacoeconomics

118. Celecoxib improves health-related quality of life in patients with osteoarthritis of the knee. Sean Z. Zhao, M.D., Ph.D., Shawn S. Yu, M.D., Ph.D., Seema D. Dedhiya, M.S., William W. Zhao, Ph.D., *Jane T. Osterhaus, Ph.D.*; G.D. Searle & Co., Skokie, IL.

PURPOSE: Measure the impact of celecoxib, a specific COX-2 inhibitor, on health-related quality of life (HRQOL) of patients with knee osteoarthritis (OA).
METHODS: A multicenter, placebo-controlled, double-blind 12-week trial was designed. One thousand three patients with symptomatic knee OA were randomized and received either celecoxib 50 mg, 100 mg, or 200 mg BID, naproxen 500 mg BID, or placebo. SF-36 acute health survey and disease-specific WOMAC index were administered at baseline and at weeks 2 and 12. Domain and summary QOL scores were compared among treatments using analysis of covariance (intent to treat population).
RESULTS: Baseline QOL scores were similar in all groups. Patients in the celecoxib 100 mg and 200 mg arms showed improvements in 7/8 SF-36 domains at week 2; week 12 celecoxib 100 mg or 200 mg BID showed 2- to 10-fold improvements in seven SF-36 domains (p£0.05) from baseline, compared to placebo. Relative to baseline scores, average percentage improvement at week 12 celecoxib 100 mg and placebo was 30.2% and 9.7% physical functioning, 68.6% and 25.7% role-physical, 42.0% and 15.3% bodily pain, 5.4% and 2.2% general health, 21.8% and 1.2% vitality, 11.1% and -1.5% social functioning, 20.8% and 0.2% role-emotional, and 4.9% and -1.2% mental health SF-36 domains, respectively. There were no statistical differences between celecoxib 100 mg, 200 mg, and naproxen arms on any SF-36 domains. Celecoxib significantly improved the three WOMAC domains of pain, stiffness, and functioning at weeks 2 and 12 compared with placebo (p£0.01). Celecoxib 100 mg BID had a greater reduction in WOMAC pain score compared with naproxen (p£0.05).
CONCLUSION: Celecoxib significantly improves general and disease specific HRQOL of patients with knee OA.

119. Health-related quality of life evaluations in an outpatient psychiatric clinic: patients' and physicians' perceptions. *José A. Feio, Pharm.D.*, Francisco Batel-Marques, Pharm.D., Ph.D., Pedro L. Ferreira, Ph.D., Agnelo M. Silva, M.D., Ana Araujo, M.D.; University of Coimbra, Portugal; Sobral Cid Psychiatry Hospital, Coimbra, Portugal.

PURPOSE: Quality of life information is of value in the clinical decision making process. The aim of this study was to assess patients' perception of their own health-related quality of life (HQL) and physicians' perspectives of patients' HQL to find out whether clinicians' judgments matched with patients' reported HQL status.
METHODS: Psychiatric outpatients were recruited and asked to complete a set of questionnaires comprising the Portuguese versions of the Medical Outcomes Study SF-36 and the Sickness Impact Profile (SIP). At the end of each clinic visit, psychiatrists were asked to complete a form, rating from "very bad" to "very good" their perspective of patients' HQL, according to both questionnaires' dimensions. Scores found for the SF-36 and SIP were further compared and scaled to those obtained from psychiatrists' forms.
RESULTS: Three hundred fifty-two (71% female, median age 48 years, range 15-87 years) were evaluated over a 9-month period. Mean rank scores for both questionnaires were compared and scaled to those obtained for psychiatrists' evaluations.

SF-36	Original Physician	Scaled Patient	Physician	Patient	n
Physical function (PF)	58.04	58.55	100.00	93.67	339
Role physical (RP)	33.87	53.30	1.79	56.36	341
Bodily pain (BP)	48.08	59.44	59.53	100.00	331
General health (GH)	37.71	57.48	17.39	86.07	341
Vitality (VT)	33.51	50.15	0.33	33.97	335
Social function (SF)	54.23	57.27	84.52	84.58	337
Role emotional (RE)	33.43	45.37	0.00	0.00	335
Mental health (MH)	35.03	49.55	6.50	29.71	334
SIP	Original Physician	Scaled Patient	Physician	Patient	n
Ambulation (A)	12.23	35.19	20.80	5.06	341
Body care and movement (BCM)	13.32	34.12	23.97	0.00	337

Home management (HM)	21.85	46.34	48.78	57.83	335
Recreation and pastimes (RP)	27.49	55.25	65.18	100.00	338
Social interaction (SI)	33.85	50.22	83.68	76.19	341
Emotional behavior (EB)	39.46	54.69	100.00	97.35	336
Sleep and rest (SR)	25.69	53.28	59.95	90.68	335
Eating (E)	5.08	43.82	0.00	45.91	340
Communication (C)	21.44	42.33	47.59	38.85	339
Work (W)	13.47	48.74	24.40	69.19	337

CONCLUSIONS: Comparisons between mean rank scores obtained for both questionnaires and forms completed by psychiatrists revealed that patients' physical function and physical role dimensions (PF, RP, BP, A, BCM, HM, and W) were more impaired according to the physicians' views compared to patients' perceptions. For emotional role and emotional behavior-related dimensions (RE, EB, and C), differences were not found. Besides providing coherence between both HQL instruments, these results provide evidence of the usefulness of assessing HQL information in the patient care process and for further identifying the code of references of psychiatrists in valuing HQL dimensions.

120. Inpatient cost and resource utilization for Parkinson's disease. *Dilesh Doshi, Pharm.D.*, Mary Lou Chatterton, Pharm.D.; Thomas Jefferson University, Philadelphia, PA.

PURPOSE: To determine inpatient resource use, cost, and major cost drivers for idiopathic Parkinson's disease (PD).
METHODS: This was a retrospective study, evaluating patients admitted at a large academic medical center between July 1994 and June 1997 with a primary or secondary diagnosis of PD. Average length of stay (ALOS), resource use, institutional cost (including overhead), demographics, and admission severity information was extracted from the inpatient cost accounting system. The specific resources and costs were then grouped into categories based on type of service provided.
RESULTS: Sixteen patients with primary (PDX) and 378 patients with secondary diagnosis (SDX) of PD were identified. Of the 378 SDX patients, 54 had a PD-related primary diagnosis and were included in the analysis. Although the PDX group had more clinical instability at admission than the SDX group, they cost less ($8145 vs $18,617/patient) due to shorter ALOS (7.9 vs 14.3 days). Cost due to rehabilitation and other services such as cast room and surgical care were higher in the SDX group, presumably due to 85% of these patients having acute rehabilitation or falls related to their diagnoses. For both groups, nursing care was the major cost driver.

Category	Lab	EEG/EKG/EMG	Pharmacy	Rehab	Radiology	Nursing	Other
PDX (%)	5.48	2.28	2.98	3.4	7.73	73.20	4.94
SDX (%)	3.48	0.57	5.4	7.64	4.79	58.37	19.76

CONCLUSION: At this hospital, very few admissions were due to PD (70 patients over 3 years). If admitted, these patients are usually treated for reasons related to their PD, such as fractures that use more resources and incur higher costs than the PDX group. Providing better care at home and applying appropriate safety precautions may decrease these admissions, saving resources and money.

121. Evaluation of a trial prescription program in Nova Scotia. *Ingrid S. Sketris*, Pat King, Dawn M. Frail, George Kephart, John Hoar, Cherie Coleman; Dalhousie University, Halifax, NS, Canada.

PURPOSE: This study evaluated the trial prescription program in Nova Scotia.
METHODS: On December 1, 1993, the Nova Scotia government introduced a trial prescription program for the following drugs: captopril, diclofenac, diltiazem, enalapril, indomethacin, lovastatin, nifedipine, nitroglycerin, pentoxifylline, piroxicam, quinidine, sulindac, tiaprofenic acid, and verapamil. Pharmacists provided a 7-day supply of drug to determine tolerability and received a full professional fee. When the trial prescription was tolerated and the balance filled, the pharmacist received an additional fee (half of the professional fee). Administrative claims data from the Nova Scotia Seniors Pharmacare Program (a provincially funded program for approximately 100,000 individuals age 65 and over) was accessed for the period December 1, 1993 to March 31,1994. The total number of trial prescriptions initiated and those for which the balance was filled were documented.
RESULTS: A total of 281 trial prescriptions for 271 patients were filled. A balance of prescription was not filled in 78 instances; 71 of 230 pharmacies used the program. Pharmacies used the program 3.96 ± 4.49 times. The classes of eligible drugs most frequently in the program during the study were calcium channel blockers (30%), angiotensin converting enzyme inhibitors (28%), and NSAIDs (26)%. The usage of the program was limited because it was not user friendly. For example, 117,435 nifedipine prescriptions were filled during the study period resulting in only 70 trial prescriptions (24 did not have the balance filled). If a 60-day prescription period was assumed, the drug cost savings were $5607 with a range of $22-137/prescription ($4497 with program costs subtracted).
CONCLUSION: The trial prescription program was used and resulted in cost savings. Further work is needed to document the impact of the program on patient care.

122. Cost-minimization analysis in post-remission therapy of adult acute myeloid leukemia. Isabelle Menard, *Marie-Christine Woronoff-Lemsi*, Francis Witz, Henri Guy, Jean-Luc Harousseau, Jean-Yves Cahn, Patrick Arveux for The Groupe Ouest Est Leucémies Aiguës Myéloblastiques et Autres Maladies du Sang; Besançon University Hospital, Besançon, France; Brabois University Hospital, Vandoeuvre, France; Le Bocage University Hospital, Dijon, France; Nantes University Hospital, Nantes, France.

PURPOSE: The aim of this study was to carry out a cost-minimization analysis comparing post-remission therapy of acute myeloid leukemia de novo (AML) in adults from a clinical trial, the Groupe Ouest Est Leucémies Aiguës Myéloblastiques et Autres Maladies du Sang.
PATIENTS AND METHODS: For the cost analysis, 65 patients from four teams were studied. They were included between November 1987 and May 1994, and evaluable after randomization between the second course of intensive consolidation (ICC-2) and an autologous bone marrow transplantation (ABMT). Resources used, direct logistic, and medical costs were identified, and a sensitivity analysis performed. Medical costs were identified for each patient. Number of days of hospitalization, laboratory tests, transfusions, and drugs were used. Monetary values for 1997 French prices were used for all components. The exchange rate used was U.S. $1 = FRF 6. This analysis was performed from the point of view of the hospital institution.
RESULTS: The cost of post-remission therapy amounted to U.S. $95,128 for the ABMT group and U.S. $73,935 for the ICC-2 group, leading to a cost savings of U.S. $21,193. The total cost of AML therapy amounted to U.S. $143,695 for the ICC-2 group and U.S. $167,224 for the ABMT group. The first year of treatment has been estimated at U.S. $97,205 for the ICC-2 patients and U.S. $110,975 for the ABMT patients.
CONCLUSION: The ICC-2 treatment was a less expensive therapy than autologous bone marrow transplantation for all the steps of treatment.

123. Comparative evaluation of the cefepime Q12 hour dosing schedule as empiric monotherapy in febrile neutropenic patients. *Robert C. Owens, Jr., Pharm.D.*, Christy A. Owens, Pharm.D., William J. Holloway, M.D.; Maine Medical Center, Portland, ME; University of Vermont; Yale University, New Haven, CT; Christiana Care Health System, Wilmington, DE.

PURPOSE: Based on the available clinical data, a pharmacodynamic analysis indicating a time above the MIC for at least 50% of the dosing interval against typically encountered pathogens, and potential economic benefits, we converted our formulary from ceftazidime to cefepime (dosed every 12 hours, excluding central nervous system infections and cystic fibrosis patients) hospital-wide, including in our oncology units. Although the efficacy of cefepime administered 2 g every 8 hours as monotherapy for the empiric treatment of febrile neutropenic patients is well established, limited data exist employing cefepime every 12 hours for this purpose. Furthermore, our purpose was to examine the efficacy and costs of therapy in a clinical practice setting, specifically our oncology units, following a formulary interchange.
METHODS: To evaluate the clinical and economic impact of our conversion, we designed a prospective, non-interventional, investigator-blinded study comparing cefepime 2 g every 12 hours with ceftazidime 2 g every 8 hours as monotherapy for febrile neutropenic episodes. No other antibiotic policies or substitutions were introduced during the study period. The study was constructed using standard guidelines issued by the Infectious Diseases Society of America and the Immunocompromised Host Society. Pediatric patients (less than 18 years) were excluded and adult patients who were enrolled were further stratified by cancer type (e.g., solid tumor, myeloma/lymphoma, leukemia) and by infection designation (e.g., microbiologic, clinical, fever of unknown etiology).
RESULTS: Treatment arms were balanced with regard to patient demographics and infection risk factors. In addition, 12% of patients in each group underwent bone marrow or stem cell transplantation. The median duration of neutropenia (and range) for patients receiving cefepime and ceftazidime was 5 days (1-24) and 4 days (1-22), respectively. The percentage of patients with an absolute neutrophil count less than 100 for the cefepime and ceftazidime groups were 65% and 73%, respectively. Monotherapy failure was defined as any addition of another antibacterial agent to the regimen. Groups were further analyzed for response to treatment strategy (monotherapy with addition). Overall success rates to initial cefepime and ceftazidime monotherapy were 36.7% (18/49) vs 12% (6/50), respectively. Overall success rates to treatment strategy (cefepime vs ceftazidime) were 96% (47/49) and 78% (39/50), respectively. The most frequently added antibiotic to initial monotherapy was vancomycin in both groups, cefepime 53% (26/49) and ceftazidime 78% (39/49). A level one pharmacoeconomic analysis demonstrated reduced costs associated with cefepime treated patients compared with those receiving ceftazidime. Levels II-III analyses to evaluate total costs of therapy are in progress. In addition, the formulary replacement of ceftazidime with cefepime on our oncology floors was followed by an increase in susceptibility to *Enterobacter cloacae* isolates from 1997 to 1998 for ceftazidime (66.4%/92.3%), cefotaxime (66.7%/84.6%), piperacillin (50%/84.6%), and ticarcillin/clavulanate (50%/90%), respectively, results similar to other institutions that have interchanged these agents. Adverse

events were infrequent for cefepime (8.2%) vs ceftazidime (10%), the most common in each group being dermatologic (rash).
CONCLUSION: The results indicate that the cefepime every 12 hours dosing interval is both safe and effective as initial empiric monotherapy for the treatment of fever and neutropenia and was also associated with further economic and ecological benefits. In addition, vancomycin was added to cefepime therapy less often compared with the ceftazidime group, a benefit that may be useful in programs designed to limit the use of the glycopeptides.

124. Comparison of administrative databases used to describe pediatric asthma patients. *Larry M. Lloyd, Pharm.D., MBA*; Celebration Health, Florida Hospital Orlando, Orlando, FL.

PURPOSE: Hospital administrative databases are frequently queried to assess frequency and cost of specific diseases to substantiate programs, to prove the value of interventions, or to assemble disease surveillance reports. The aim of this study was to evaluate the validity of using a pediatric hospital's claims database to describe patient utilization and cost of asthma.
METHODS: This study compared populations selected from the hospital's claims database with populations selected from an MCO database. First, patients from the MCO were selected from the hospital database using ICD-9 codes. After these patients were selected, their entire hospital history for the study period was queried from the hospital database to reveal non-asthma coded hospitalizations. Finally, the MCO database was queried to extract hospitalized pediatric patients who used inhaled antiasthma medications as outpatients. The database queries were summarized and results compared.
RESULTS: The initial query of hospital records by ICD-9 codes produced records of 111 children from the MCO with an inpatient hospital stay for asthma during the study period. The MCO query of inhaled asthma medication prescription users produced 59 children who had been hospitalized. Forty-four children were identified on both lists. The 111 children had 146 admissions for asthma, but 192 total admissions. In these admissions, if asthma was a discharge code, it was one of 2.2 diagnoses; overall hospitalizations for these children used 3.85 diagnoses per patient.
CONCLUSION: A hospital diagnosis of asthma may not be an accurate marker of disease prevalence as patients with this diagnosis present with a variety of other problems and they are not treated outside the hospital with inhaled medications.

125. The pharmacoeconomics of IV therapy in pediatric intensive care. *Chris J. Cairns, M.S., M.R.Pharm.S.*, David Armour, B.Sc., M.R.Pharm.S., Ian Costello, M.Sc., M.R.Pharm.S., Ruth Meadows, R.G.N., Simon K. Riley, B. Pharm., M.R.Pharm.S., Kate Stephenson, B.Sc., M.R.Pharm.S.; St. George's Hospital, London, United Kingdom.

PURPOSE: Centralized intravenous additive services (CIVAS) are not widespread in the United Kingdom (UK). Pediatric intensive care units (PICU) presently have major problems recruiting trained nursing staff and CIVAS may be of benefit in helping to address this. This study was designed to quantify the resource implications of a nonantibiotic CIVAS for a PICU.
METHODS: Preparation of IV doses was timed using a stop watch by an independent observer for nurse preparation in the PICU and pharmacy preparation in the CIVAS unit. There were 59 doses in each group. Staff costs were calculated from salary scales and the cost of diluents and disposables added. Sensitivity analyses for staff mix and London weighting were performed.
RESULTS: The time taken for a nurse-prepared dose was 689 seconds and that for CIVAS was 529 seconds. The total cost for a nurse-prepared dose was £3.00 and for CIVAS was £2.60, a cost ratio of 1:1.2 in favor of CIVAS. The relative contributions of staff, diluents, and disposables were, respectively, £1.83, £0.47, and £0.70 for nurse preparation and £1.22, £0.29, and £1.09 for CIVAS. London weighting made no difference to the cost ratio. However, skill mix modeling showed that pharmacy maximum costs were equal to nurse minimum costs and the ratio of cost difference between pharmacy minimum costs (£2.18) and nursing maximum costs (£3.66) was 1:1.4.
CONCLUSIONS: This study has demonstrated that in the UK health care system, pharmacy-based CIVAS is better value for the money than traditional ward-based preparation in the PICU.

126. Celecoxib improves health-related quality of life in patients with rheumatoid arthritis. *Sean Z. Zhao, M.D., Ph.D.*, Shawn S. Yu, M.D., Ph.D., Seema D. Dedhiya, M.S., William W. Zhao, Ph.D., Jane T. Osterhaus, Ph.D.; G.D. Searle & Co., Skokie, IL.

PURPOSE: Measure the impact of celecoxib, a specific COX-2 inhibitor, on health-related quality of life (HRQOL) of rheumatoid arthritis (RA) patients.
METHODS: A multicenter, double-blind, placebo-controlled 12-week trial was designed. One thousand one hundred forty-eight patients with symptomatic RA were randomized and received either celecoxib 100 mg, 200 mg, or 400 mg BID, naproxen 500 mg BID, or placebo. The SF-36 Health Survey (SF-36) was administered at baseline and week 12. The disease-specific health assessment questionnaire (HAQ) was administered at baseline, and at weeks 2, 6, and 12. Analysis of covariance on the intent to treat population was used to compare the QOL scores among treatments.
RESULTS: Baseline QOL scores were similar across all groups. Celecoxib 200 mg and 400 mg arms improved from baseline to week 12 on all eight domains and two component scores of SF-36 ($p<0.05$). Compared with placebo, celecoxib 200 mg and 400 mg arms showed 3- to 10-fold improvement in the SF-36 domains. Improvements in vitality and social function were greater in celecoxib 200 mg BID than naproxen ($p<0.01$). Relative to baseline, the average percentage improvement in celecoxib 200 mg and placebo arms was 25% and 2% physical functioning, 67% and 23% role-physical, 37% and 6.3% bodily pain, 7% and -2% general health, 27% and -1% vitality, 18% and -6% social functioning, 26% and 2% role-emotional, and 5% and -1% mental health SF-36 domains, respectively. For the HAQ, celecoxib 200 mg and 400 mg BID significantly improved patients' ability to rise, walk, reach, grip, and perform other activities; average HAQ disability index improvements were 0.3, 0.2, and 0.1 for celecoxib 200 mg, naproxen, and placebo, respectively (all p£0.05 vs placebo).
CONCLUSION: Celecoxib significantly improves HRQOL in RA patients.

127. Costs of NSAID-induced nonhospitalized gastrointestinal discomfort among arthritis patients: a retrospective claims analysis coupled with expert opinion. *Thomas A. Burke, Pharm.D.*, George Triadafilopoulos, M.D., Brian R. Kaye, M.D., Kathleen F. Villa, M.S., Sara K. Sherif, B.A., Daniel Pettitt, D.V.M., M.S., Richard A. Zabinski, Pharm.D.; Searle Pharmaceuticals, Skokie, IL; Stanford University; University of California San Francisco, San Francisco, CA; Lewin-TAG Inc.; Pfizer Inc.

PURPOSE: Estimate costs of NSAID-induced nonhospitalized gastrointestinal discomfort among arthritis patients.
METHODS: Patients with an NSAID prescription between July 1, 1994 and June 30, 1997 were identified using claims data from eleven United HealthCare (UHC) plans. Patients with an osteoarthritis or rheumatoid arthritis claim prior to or within 90-days of an NSAID claim were included. Complication-specific resources were identified a priori and collected from claims with a primary diagnosis code of abdominal pain, dyspepsia, heartburn, or gastroesophageal reflux disease, and assigned costs using Medicare and UHC data. To attribute resource use to NSAIDs, events occurring within 90 days of the last days' supply of an NSAID were considered. Resource use of the initial gastrointestinal discomfort claim, in addition to outpatient resource use during a 167-day follow-up period, were collected. Nonhospitalized gastrointestinal discomfort episodes in which one or more complication-specific resources was consumed were included. Data were reviewed and modified by an expert panel.
RESULTS: One thousand of 1129 gastrointestinal discomfort events identified contained at least one complication-specific resource. Average number of procedure/laboratory resources utilized per episode were: endoscopy (0.09), radiology exam (0.07), echography (0.11), chemistry panel (0.09), and *H. pylori* test (0.01). Physician visits averaged 1.34 per episode. Percentage of patients receiving medications were: H_2-receptor antagonist (37.4%), proton pump inhibitor (21.1%), and antibiotics (31.3%). Average claims-based costs were $303 per episode. Expert panel-adjusted costs were $508, based on upward adjustments for *H. pylori* tests, procedures, and CBCs potentially underestimated by claims data.
CONCLUSION: Less severe NSAID-induced events, such as gastrointestinal discomfort, contribute to the economic burden of NSAID-therapy. Claims estimates may be inconsistent with expert clinician opinion.

128E. Economic comparison of sevoflurane/sevoflurane versus propofol/desflurane anesthesia. *C. Pitré, P.D.*, B. Huiban, M.D., G. Piriou, P.D., M. Hamoud, M.D., P. Assicot, P.D., C. L'Eilde, P.D., N. Borgnis-Desbordes; Brest University Hospital, Brest, France; Morlaix Hospital, Morlaix, France.

Presented at the Congrès de la Société Française de Pharmacie Clinique, Lyon, France, September 17-18, 1998.

129. Cost-consequence analysis: intravenous immunoglobulins versus plasmapheresis in the treatment of Guillain-Barre syndrome. F. Bailly-Sailins, G. Capellier, M.D., Ph.D., F. Pouthier, M.D., J.L. Dupond, M.D., Ph.D., M.D. Wendling, M.D., Ph.D., *M.C. Woronoff-Lemsi, Pharm.D., Ph.D.*; University Medical School Hospital, Besançon, France.

PURPOSE: Current specific treatment of the Guillain-Barre syndrome (GBS), immune-mediated subacute polyneuropathy, consists of intravenous immunoglobulins (IVIG) or plasmapheresis (PL), used with equivalent efficacy. In view of the highly technical nature of plasmapheresis and the high price of immunoglobulins, it was decided to evaluate consumption products from diagnosis until recovery.
METHODS: This retrospective study included 14 patients treated in the Besançon University Hospital (BUH) from 1994 to 1998. Eight patients were treated with IVIG and six with PL. Only direct costs were collected. GBS diagnosis was confirmed by analysis of cerebrospinal fluid and electromyography. The point of view of the payer (French Health Care Insurance System [HCIS]) was adopted. Data collected from the medical records were drugs, blood products, laboratory and radiological tests (LRT), hospital days in the BUH, and functional re-education centers (FRC). Drug costs were calculated using the 1997 and 1998 French prices.
RESULTS: In the IVIG group, the mean cost was U.S. $166 for diagnosis, U.S. $1767 for LRT, U.S. $3875 for Ig, U.S. $79 for the others drugs, U.S.

$7538 for hospitalization in the BUH, and U.S. $7100 for hospitalization in FRC. In the PL group, the mean cost was U.S. $186 for diagnosis, U.S. $4328 for LRT, U.S. $4768 for PL, U.S. $546 for drugs, U.S. $26,362 for hospitalization in the BUH, and U.S. $29,435 for hospitalization in FRC.
CONCLUSION: The heterogeneity of these results reflected the difference of illness severity between patients.

130. An investigation of asthmatic and diabetic patients' perceived satisfaction with information about medicines. Rob Horne, Ph.D., M.R.Pharm.S., *Alice Ward, M.R.Pharm.S.*; University of Brighton; Guys and St Thomas' Trust, London, United Kingdom.

PURPOSE: It is widely recognized that providing patients with information about their medications
facilitates treatment adherence. However, individual patients receiving the same medication may have different information requirements. This investigation aimed to identify whether diabetic and asthmatic patients are satisfied with the information they are receiving about their medications.
METHODS: A validated questionnaire, the Satisfaction with Medication Information Scale questionnaire, was used to assess diabetic and asthmatic outpatients' ratings of their satisfaction with the information they had received about their medications. The five possible ratings were dichotomized into satisfaction (about right and none needed) and dissatisfaction (too much, too little, and none received). Data was collected between September 1997 and February 1998 by hospital preregistration graduates within South Thames.
RESULTS: Three hundred twenty-one outpatients completed the questionnaire; 48% were asthmatic and 52% diabetic. The majority of patients were satisfied with information provided regarding the practical aspects of medicine use (e.g., name of medicine). Patients were not satisfied regarding the information received about the risks of getting side effects (62%), what to do if they experienced side effects (58%), and the effect of their medicines on their sex life (64%).
CONCLUSIONS: In this sample, patients on the whole were satisfied with the information received about the practical aspects of medicines, but generally not satisfied with information related to side effects and sex life. Health care professionals, particularly pharmacists, need to address these issues to ensure this information is provided.

131. The social costs for asthma in Italy. *Annita Cinzia Bonzanini*, Fabrizio Gianfrate, Marilde Alessandra Massimetti, Renato Testi; Glaxo Wellcome S.p.A., Verona, Italy.

PURPOSE: There is a growing international concern about increasing asthma morbidity and related costs. In the present study, an attempt was made to quantify the burden of illness in Italy, in terms of increased medical consumption and lost productivity, associated with undertreated asthma.
METHODS: In 1997, Euroasthma conducted an epidemiologic study in five European countries. From 824 attendees treated with antiasthmatics drugs, 362 subjects with a current diagnosis of asthma were enrolled in the second stage of this study. To estimate the cost of illness, data were collected regarding health care resources consumption and productivity losses.
RESULTS: We estimate that the asthma prevalence in Italy is 4.4%. The total cost of asthma, the sum of direct and indirect costs, is worth 2244 billion lire (for an asthmatic population of 1,300,000 people). We have not included intangible costs because they cannot be quantified correctly as yet.
CONCLUSIONS: As in other studies, we conclude that one of the major reasons for the high consumption of health care resources by asthma is the high rate of underdiagnosis and undertreatment, which are characteristics of this disease. Incorrect diagnosis results in inappropriate treatment.

132. The cost effectiveness of inhaled fluticasone proprionate and budesonide in the treatment of asthma in adults and children. *Annita Cinzia Bonzanini*, Fabrizio Gianfrate, Lloyd Adam, Renato Testi; Glaxo Wellcome S.p.A., Verona, Italy; Glaxo Wellcome, United Kingdom.

PURPOSE: Asthma is an increasingly common, chronic disease in both adults and children that imposes a substantial burden on the patient, on the health care system, and on society as a whole in terms of mortality, morbidity, and economic costs. This study compared the costs and effectiveness of fluticasone propionate (FP) and budesonide (BUD) in the treatment of asthma in Italy.
METHODS: The perspective taken was that of the Italian health care system, and the population was a mixture of adults and children with asthma of varying severity included in a recently published meta-analysis.
RESULTS: Patients treated with FP were, on average, successfully controlled for 41.7% of treated weeks compared with 34.1% in the BUD group ($p<0.001$). The FP group also showed significantly greater improvements in symptom-free days, symptom-free 24-hour periods, and episode-free days. The overall mean weekly cost per patient was 26,078 lire for patients treated with BUD and 14,624 lire for patients treated with FP.
CONCLUSIONS: The total expenditure per week of successful treatment was 37,191 lire for patients treated with FP and 89,573 lire for patients treated with BUD. FP was more cost effective than BUD for all effectiveness endpoints assessed. The results of this large study of adults and children with asthma should be relevant to a primary care population in Italy.

133. Assessment of patient satisfaction with a formulary switch from omeprazole to lansoprazole in gastroesophageal reflux disease maintenance therapy. Laura J. Condra, Pharm.D., *Anthony P. Morreale, Pharm.D., BCPS, MBA*, Stephen N. Stolley, Pharm.D., BCPS, David Marcus, B.S.; Veteran Affairs San Diego Healthcare System, San Diego, CA.

PURPOSE: The purpose of the study was to determine if patients perceived a difference in the efficacy, side effects, and value of omeprazole versus lansoprazole for gastroesophageal reflux disease (GERD) maintenance therapy after a formulary conversion, and to evaluate the cost effectiveness of the conversion.
METHODS: An unblinded questionnaire was mailed to patients who were currently receiving GERD maintenance therapy with lansoprazole from the Veterans Affairs San Diego Healthcare System (VASDHS). Three hundred patients who were on both agents for a minimum of 2 months were surveyed. Patients were asked to rate the severity and frequency of their symptoms (pain, heartburn, and regurgitation) on a scale from zero to nine for each medication. Questions regarding side effects, quality of life, medication preference, and satisfaction with the formulary conversion process were also addressed.
RESULTS: Fifty-two percent of the surveys were returned. There was no statistically significant difference between total symptom scores for omeprazole and lansoprazole (3.34 vs 3.89, respectively). More patients reported side effects to lansoprazole ($p<0.001$). Sixty-four percent of patients preferred omeprazole ($p<0.005$). The formulary conversion was estimated to save $29,000 per year.
CONCLUSION: Omeprazole was preferred by patients at the VASDHS for GERD maintenance therapy. Patients were willing to pay an additional fee for their preferred agent. Fewer adverse events were reported with omeprazole. The potential cost savings of the formulary conversion may have been at the expense of patient satisfaction.

134. Development and validation of the Satisfaction with Pharmacist scale. *L. Hernández*, C.H. Chang, D. Cella, M. Corona, L. Gelabert, S. Deasey; University of Puerto Rico, San Juan, PR.

PURPOSE: To develop and validate a scale to assess patient satisfaction with pharmacist (SWiP).
METHODS: The scale was developed with the collaboration of five pharmacy practice faculty members and 11 cancer patients. The study included English- and Spanish-speaking participants in a multisite validation of the functional assessment of cancer therapy scale. Of the 1617 cancer and HIV/AIDS patients, 1124 had seen a pharmacist in the past 7 days and were eligible. Of these, 608 were English speaking and 516 were Spanish speaking. The seven items of the patient satisfaction with pharmacist (SWiP) scale were rated on a 5-point Likert scale (0 = not at all; 4 = very much). The reliability of the English and Spanish versions of the scale were evaluated using Cronbach's alpha coefficients. The unidimensionality and construct validity were analyzed using a Rasch rating scale analysis.
RESULTS: Alpha reliability for the English and Spanish versions were 0.90 and 0.92, respectively. Rasch analysis of item difficulty showed that, except for item 6 in English, all items were easy to endorse by English and Spanish speaking patients. The English version of the SWiP scale was modified to better reflect the intent of item 6. None of the items in each language was misfitting using the MNSQ < 0.7 and MNSQ > 1.3 rules.
CONCLUSIONS: The SWiP scale possesses reliable and valid psychometric properties in both English and Spanish. It is easy to administer and should be further evaluated to assess and document outcomes of pharmaceutical care.

135. Decision analysis model for rotavirus immunization program in managed care. Brandon S. Ou, Pharm.D. candidate, *Marsha A. Raebel, Pharm.D., FCCP, BCPS*; University of Colorado, Denver, CO; Kaiser Permanente Rocky Mountain Division; Aurora, CO.

PURPOSE: To estimate the economic impact of a rotavirus immunization program in a group model health maintenance organization (HMO).
METHODS: A decision analysis model was developed to analyze costs from the perspective of the HMO over a 1-year period. The decision tree used estimates of disease burden, birth cohort, vaccine safety and efficacy, costs, and prices obtained from published and site-specific sources. Vaccine was proposed to be administered to infants aged 2, 4, and 6 months as part of routine childhood immunizations. The target population included children ages 6 to 24 months who become ill from rotavirus infection. Sensitivity analyses were one-way. Main outcome measures included total costs, cost per case prevented, and cost per health system encounter prevented.
RESULTS: A routine, universal rotavirus vaccination program in our HMO would prevent an estimated 400 cases of diarrhea (of severity sufficient to result in a physician visit), save approximately 28 emergency department visits, and avoid 16 hospitalizations annually. At $38 per dose, the net cost of the vaccination program is over $550,000 annually and costs approximately $1300 per case prevented or $36,000 per hospitalization prevented. Within the range of sensitivity analyses performed, the costs of the immunization program would not be offset by the cost of disease prevented.
CONCLUSIONS: In one managed care system, a rotavirus immunization

program is not cost effective, especially when compared to other vaccination programs such as those against hemophilus, pneumococcus, or influenza disease.

Pharmacokinetics

136. Bioavailability of UMF-078, a candidate benzimidazole carbamate for onchocerciasis, in infected dogs. *Roongtip Theplertboon, M.S.*, Lawrence Fleckenstein, Pharm.D., Mike T. Dzimianski, D.V.D, M.S., John W. McCall, Ph.D.; University of Iowa, Iowa City IA; University of Georgia, Athens, GA.

PURPOSE: To study the bioavailability of UMF-078, a candidate benzimidazole compound under development by WHO for onchocerciasis, in infected beagles.
METHODS: Eighteen beagles infected with *Brugia pahangi* were randomly allocated to three groups of six. UMF-078 formulated as either a capsule or suspension in peanut oil for IM injection was given at 50 mg/kg/day BID for 3 days. Plasma samples were collected at intervals from 0-720 hours post-treatment and analyzed by HPLC. Pharmacokinetic parameters were derived from compartmental modeling using WinNonlin; group comparisons utilized the t-test.
RESULTS: The plasma UMF-078 data for IM administration were fitted to a 1-compartment model, whereas data from PO administration were fitted to a 2-compartment model. The K_{01} of IM is 0.06 hr^{-1} compared to 0.37 hr^{-1} for PO ($p<0.05$). The K_{10} of IM is 0.003 hr^{-1} compared to 0.06 hr^{-1} for PO ($p<0.05$). The K_{01} and K_{10} of the two dosage forms apparently interchanged with each other. This observation is explained by flip-flop phenomenon. The C_{max} and T_{max} for the PO group is significant higher and faster than those for the IM group, respectively ($p<0.001$). The higher plasma levels were associated with vomiting in the PO group. The AUC for PO regimen is significant higher than the IM regimen ($p<0.005$), explained by prolonged absorption of UMF-078 after IM administration.
CONCLUSIONS: IM administration of UMF-078 produces sustained and low plasma levels (10-1,000 ng/ml) over 720 hours. In contrast, oral administration gives high peak plasma levels (in the range of 10,000 ng/ml), with faster and more erratic absorption than IM administration.

137. Saliva-serum correlation of acetaminophen concentrations after three different forms of tablet administration. *Tina W. Hahn, M.S.*, Dorte Almstrup, Lona Christrup, M.S., Ph.D, Klaus Glahn, M.D., Niels-Henrik Jensen, M.D., Ph.D., Mette Rasmussen, M.S., Ph.D.; The Royal Danish School of Pharmacy, Copenhagen, Denmark; University Hospital, Herlev, Denmark.

PURPOSE: To investigate if the elevated saliva-serum ratios (SA-SE ratio) of acetaminophen during the absorption phase observed in other studies could be due to tablet remnants in the oral cavity after tablet ingestion.
METHODS: Twelve fasting, healthy male volunteers (age 19-29 years) were given 1500 mg acetaminophen as either tablets encapsulated in gelatin capsules, coated tablets, or broken tablets on three different occasions. Blood and saliva samples were collected every 15 minutes (0-2 hours) and every 30 minutes (2-5 hours) following the administration.
RESULTS: The saliva and serum concentrations resulted in correlation coefficients (r^2) during the absorption phase (concentrations at $t < t_{max}$) on 0.83, 0.84, and 0.59, respectively, for encapsulated tablets, coated tablets, and broken tablets. During the elimination phase (concentrations at $t > t_{max}$), the correlation coefficients were 0.67, 0.67, and 0.81, respectively. In general, 95% prediction intervals broadened going from encapsulated tablets to coated tablets to broken tablets. Mean SA-SE ratios were 0.89, 0.89, and 1.21 (absorption phase), and 0.83, 0.84, and 0.90 (elimination phase), respectively, for encapsulated tablets, coated tablets, and broken tablets. The mean SE-SE ratio for broken tablets were significantly higher than for encapsulated tablets during the absorption phase ($p=0.04$, t-test).
CONCLUSIONS: The study showed that saliva sampling after ingestion of broken tablets results in a higher SA-SE ratio and a broader 95% prediction interval in the absorption phase than ingestion of coated and encapsulated tablets. The findings suggest that an elevated SA-SE ratio in the absorption phase could be due to tablet remnants in the oral cavity after tablet ingestion.

138. Chronopharmacokinetics of sumatriptan. *Poondru Srinivasu, M.Pharm.*, Devraj Rambhau, Ph.D., Boinpally Ramesh Rao, Ph.D., Yamsani Madhusudan Rao, Ph.D.; Kakatiya University, Warangal, India.

Rhythms in the onset and symptoms of several diseases have been well established. Migraine is one such disorder which exhibits periodicity in its symptoms; hence, chronotherapy may be more beneficial in treating the problem. Designing a chronotherapeutic schedule requires chrono-pharmacokinetic data of the drugs prescribed. We have studied the chronopharmacokinetics of sumatriptan, a drug of choice in migraine treatment. Twelve healthy volunteers were treated with 100 mg sumatriptan orally at 0700, 1300, 1900, and 0100 hours in a randomized, crossover Latin square design with a wash out period of one week. Serum samples were analyzed by high performance liquid chromatography with electrochemical detector. Pharmacokinetic parameters were calculated using a model-independent method. The mean C_{max} (59.09 ± 10.53 vs 41.87 ± 12.21 ng/ml) is significantly ($p<0.05$, n=12) higher following 0700 hours administration than 1900 hours administration. The AUC_{0-t}, $AUC_{0-\infty}$, and AUMC are higher significantly ($p<0.05$, n=12) following 0700 and 0100 hours than 1900 hours administration. The mean $t_{1/2}$ (2.6 ± 0.3 vs 2.1 ± 0.4 hours), Cl_s/f (1208 ± 458 vs 781 ± 186 ml/h/kg), V_{ss}/f (5804 ± 2333 vs 3604 ± 854 ml/kg), and V_d/f (4655 ± 2096 vs 2379 ± 684 ml/kg) values are significantly higher ($p<0.05$, n=12) following 1900 hours than 0700 hours administration. The $t_{1/2}$ (2.6 ± 0.3 vs 1.99 ± 0.4 hours) and V_d/f (4655 ± 2096 vs 2763 ± 1417 ml/kg) values are higher ($p<0.05$, n=12) following 1900 hours administration than 1300 hours. These variations may be due to the time dependent changes in the metabolism of sumatriptan.

Pharmacometrics

139. Correlation of the activated clotting time test to plasma heparin concentration. *John M. Koerber, B.S.*, Maureen A. Smythe, Pharm.D., Robert L. Begle, M.D., Joan C. Mattson, M.D., Beverly P. Kershaw, M.S., Susan J. Westley, M.T., Jacquelyn E. Wright, M.T.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

PURPOSE: To determine the correlation between the activated clotting time (ACT) test and plasma heparin concentration and to compare decisions regarding heparin therapy resulting from the ACT test to those from plasma heparin concentrations.
METHODS: The study was conducted in two phases. Blood samples for ACT and heparin concentration analysis were collected from 102 continuous infusion heparin patients in phase I and 100 patients in phase II. In each phase, the correlation between the ACT and heparin concentration was determined (Pearson's moment R) along with the ACT therapeutic range (linear regression analysis). Plasma heparin concentrations were measured using the antifactor Xa assay and the ACT was measured using the Hemochron 801. The therapeutic range from each phase was used to conduct a clinical decision analysis on the data from the alternate phase. A therapeutic range of 0.3 to 0.7 units/ml was used as the gold standard for plasma heparin concentration. Decisions to adjust heparin dosing regimens were in agreement when the ACT test and plasma heparin concentration were both therapeutic or nontherapeutic.
RESULTS: Correlations for phase I and phase II yielded r=0.70 ($p<0.0001$) and 0.72 ($p<0.0001$), respectively. The linear regression analysis for phase I and phase II resulted in therapeutic ranges of 143-162 seconds and 141-160 seconds, respectively. The phase I clinical decisions based on the ACT test disagreed with the corresponding decisions based on the plasma heparin concentration in 44 of 102 patients. Of these 44 disagreements, 23 decisions may have increased the patient's risk of bleeding (heparin dose increased despite therapeutic blood heparin concentration) and 21 decisions may have increased the patient's risk of thrombotic progression or rethrombosis (heparin dose maintained or decreased despite subtherapeutic blood heparin concentration). The phase II clinical decisions based on the ACT test disagreed with the corresponding decisions based on the actual plasma heparin concentration in 38 of 100 patients. Of these 38 disagreements, 24 decisions may have increased the patient's risk of bleeding and 14 decisions may have increased the patient's risk of thrombotic progression or rethrombosis.
CONCLUSIONS: Despite significant correlation between the ACT test and plasma heparin concentrations, the ACT test results may lead to incorrect decisions regarding heparin dosing in approximately 40% of patients.

140. Evaluation of a bedside activated partial thromboplastin time analyzer. *John M. Koerber, B.S.*, Maureen A. Smythe, Pharm.D., Robert L. Begle, M.D., Joan C. Mattson, M.D., Beverly P. Kershaw, M.S., Susan J. Westley, M.T., Jacquelyn E. Wright, M.T.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

PURPOSE: To evaluate the influence of operator variability on the activated partial thromboplastin time (aPTT) result using a bedside analyzer (Thrombolytic Assessment System™).
METHODS: The study was conducted in two phases. In phase I, blood samples from 102 patients on continuous infusion heparin were obtained and sequentially analyzed for two bedside aPTT results (utilizing analyzers identified as TAS#1 [single operator] and TAS#2 [multiple operators]). Blood samples were also analyzed for heparin concentrations (by antifactor Xa assay). A linear regression was performed to define the therapeutic range for each analyzer. In phase II, blood samples from 99 patients were obtained and analyzed for the aPTT (with both TAS analyzers) and heparin concentration. A Pearson's moment R analysis was performed to determine the correlation between the aPTT results from each analyzer and heparin concentration and the correlation between both analyzer's aPTT results. A clinical decision analysis was conducted to determine the possible consequences of dosage adjustments based on either aPTT test in relation to the heparin concentration. Decisions were in agreement when the aPTT test and heparin concentration were both therapeutic or nontherapeutic.
RESULTS: Therapeutic ranges for phase I were 47-76 seconds for TAS#1 and

47-63 seconds for TAS #2. Phase II correlations yielded r values of 0.50 ($p<0.0001$) for TAS#1 and heparin concentration, 0.68 ($p<0.001$) for the TAS#2 and heparin concentration, and 0.54 ($p<0.0001$) for the TAS #1 and TAS #2. Individual operator correlation (n=8) for the TAS #2 and heparin concentration ranged from 0.47-0.90. The coefficient of variation for TAS #1 and TAS #2 were 6-7% and 6-8% for normal controls and 7-13% and 7-12% for abnormal controls, respectively. Phase II clinical decisions based on the TAS#1 disagreed with the corresponding decisions based on the heparin concentration in 35 of 99 patients. The clinical decisions based on the TAS#2 disagreed in 41 of 99 patients.
CONCLUSIONS: Significant correlation exists between each analyzer and heparin concentration as well as between the two analyzers. Operator variability does not appear to influence the overall level of agreement between aPTT results and heparin concentrations.

141. Correlation of the activated partial thromboplastin time to plasma heparin concentration. *Maureen A. Smythe, Pharm.D.*, John M. Koerber, B.S., Robert L. Begle, M.D., Joan C. Mattson, M.D., Beverly P. Kershaw, M.S., Susan J. Westley, M.T., Jacquelyn E. Wright, M.T.; William Beaumont Hospital, Royal Oak, MI; Wayne State University, Detroit, MI.

PURPOSE: To determine the correlation between three activated partial thromboplastin time (aPTT) tests and plasma heparin concentration and to compare decisions of heparin therapy resulting from these tests to those from plasma heparin concentrations.
METHODS: The study was conducted in two phases. In phase I, blood samples from 102 patients on continuous infusion heparin were obtained and analyzed utilizing two bedside aPTT devices (Coaguchek Plus System™ [CPS] and Thrombolytic Assessment System™ [TAS] Analyzer), one laboratory aPTT device (MDA-180 Analyzer™ [MDA]), and plasma heparin concentration (by antifactor Xa). A Pearson's moment R correlation and linear regression analysis were performed to determine the strength of the correlation and to derive a therapeutic range for each aPTT test. In phase II, blood samples from 100 patients were obtained and analyzed for the same three aPTT tests and plasma heparin concentration. These results were utilized to conduct a clinical decision analysis (using the therapeutic range for each aPTT test derived in phase I). Results from the clinical decision analysis identified the possible consequences of dosage adjustments based on each aPTT test in relation to the plasma heparin concentration. Decisions were in agreement when the aPTT test and plasma heparin concentration were both therapeutic or nontherapeutic.
RESULTS: The phase I correlations yielded r values of 0.57 ($p<0.0001$) for the CPS device, 0.54 ($p<0.001$) for the TAS analyzer, and 0.76 ($p<0.001$) for the MDA analyzer. The phase II clinical decisions based on the CPS device disagreed with the corresponding decisions based on the plasma heparin concentration in 29 of 100 patients. Of these 29 disagreements, 22 may have increased the risk of bleeding in patients. Decisions based on the TAS analyzer disagreed in 41 of 99 patients (27 may have increased the risk of thrombosis in patients). Decisions based on the MDA analyzer disagreed in 20 of 100 patients (16 may have increased the risk of bleeding in patients). A significant difference ($p=0.001$) in the number of disagreements exists between the TAS device and the MDA analyzer.
CONCLUSIONS: The linear correlation for the laboratory-based aPTT is stronger than that of either bedside device. Despite significant correlations, the aPTT test results may lead to incorrect decisions regarding heparin dosing 20-41% of the time.

Pharmacy Practice

142. Pharmacist recognition of brand name extension in over-the-counter medications. *Chuck D. Lawless, Pharm.D.*, Rex W. Force, Pharm.D., Paul S. Cady, Ph.D., Vaughn L. Culbertson, Pharm.D., Cara Lawless-Liday, Pharm.D.; Idaho State University, Pocatello, ID.

PURPOSE: Pharmaceutical manufacturers are continually altering the composition of over-the-counter medications (OTC) while using the same trusted brand name. The term "brand name extension" (BNE) is used to describe this concept. BNE can be very confusing to health care providers and patients and may lead to adverse patient outcomes. A survey was designed to evaluate pharmacists' ability to recognize the active ingredient in OTC BNE products.
METHODS: Five products (Mylanta AR®, Caladryl®, Monistat-1®, Desenex AF®, and Excedrin Migraine®) that fit the description of BNE products were identified in local retail pharmacies. The questions on the survey posed possible clinical scenarios with the patient reporting use of BNE medications. Other questions obtained demographic data and OTC recommendation habits. A total of 899 surveys were sent to pharmacists in the state.
RESULTS: One hundred forty-seven of 899 (16%) surveys were returned. Most pharmacists (72.1%) reported recommending OTC medications on a daily basis and most commonly rely on personal experience for OTC information. Only 46 (31.3%) correctly identified at least three of five of the active ingredients in BNE products. However, 54 (36.7%) misidentified at least three of four BNE products, thinking they contained the old active ingredients (Excedrin Migraine® contains the same active ingredient as old Excedrin®).
CONCLUSIONS: BNE results in pharmacists being misled with regard to the active ingredients in OTC products. This may lead to adverse patient outcomes. Increasing objective OTC drug information to pharmacists may help this problem.

143. Physician recognition of brand name extension in over-the-counter medications. *Chuck D. Lawless, Pharm.D.*, Rex W. Force, Pharm.D., Paul S. Cady, Ph.D., Vaughn L. Culbertson, Pharm.D., Cara Lawless-Liday, Pharm.D.; Idaho State University, Pocatello, ID.

PURPOSE: Pharmaceutical manufacturers are continually altering the composition of over-the-counter medications (OTC) while using the same trusted brand name. The term "brand name extension" (BNE) is used to describe this concept. BNE can be confusing to health care providers and patients and may lead to adverse patient outcomes. A survey was designed to evaluate physicians' ability to recognize the active ingredient in OTC BNE products.
METHODS: Five products (Mylanta AR®, Caladryl®, Monistat-1®, Desenex AF®, and Excedrin Migraine®) that fit the description of BNE products were identified in local retail pharmacies. The questions on the survey posed possible clinical scenarios with patients reporting use of BNE medications. Other questions obtained demographic data and OTC recommendation habits. A total of 2038 surveys were sent to physicians in the state.
RESULTS: Two hundred fifty-one of 2038 (12%) surveys were returned. Most physicians (69.3%) reported recommending OTC medications on a daily basis and most commonly rely on personal experience for OTC information. Only nine (3.6%) correctly identified at least three of five of the active ingredients in BNE products. However, 73 (29.1%) misidentified at least three of four BNE products, thinking they contained the old active ingredients (Excedrin Migraine® contains the same active ingredient as the old Excedrin®). Twenty-three physicians listed Mylanta® as their most recommended OTC medication, yet only two (8.6%) correctly identified the active ingredient in Mylanta AR®.
CONCLUSIONS: BNE results in physicians being misled with regard to the active ingredients in OTC products. This may lead to adverse patient outcomes. Increasing objective OTC drug information to physicians may help this problem.

144. Validation of an instrument to measure job and career satisfaction in British hospital pharmacists. *Gail S. McPherson, M.S.*, J. Graham Davies, Ph.D., Viv Bewick, M.S., Anjana Bhudia, B.S.; Worthing & Southlands Hospitals NHS Trust, West Sussex, United Kingdom; University of Brighton, United Kingdom.

PURPOSE: In other professions, a range of factors have been shown to affect job and career satisfaction. This study aimed to validate an existing job satisfaction questionnaire with the intent of utilizing it to determine which factors are associated with job and career satisfaction in hospital pharmacists in 1998.
METHOD: The original questionnaire used a Likert scale to quantify job and career satisfaction overall and with 11 independent variables. This was revised to include demographic data and a subscale on education and training. It was piloted on 15 pharmacists and a revised questionnaire was circulated to all pharmacists employed by hospitals within the South Thames region of the U.K. (n=608). The internal consistency reliability for dependent and independent variables was assessed using Kronbach's coefficient alpha. A coefficient alpha value of 0.65 or greater indicated internal consistency.
RESULTS: Questionnaires were returned by 232 pharmacists (38%). Eight of fourteen subscales demonstrated internal consistency. Of those that were shown to be unreliable, three contained only two variables and therefore were open to statistical misinterpretation. The remaining three, pharmacist-patient relationship, pharmacist-doctor/nurse relationship, and work schedule subscales, were considered to contain statements that were not representative of current hospital pharmacy practice.
CONCLUSION: Eight dependent and independent variables were shown to be valid and reliable for use in a job and career satisfaction survey of U.K. hospital pharmacists. The reduction in the number of subscales should abbreviate the questionnaire and hence improve response rates.

145. Identification of factors affecting job and career satisfaction in hospital pharmacists. *Gail S. McPherson, M.S.*, J. Graham Davies, Ph.D., Viv Bewick, M.S., Anjana Bhudia, B.S.; Worthing & Southlands Hospitals NHS Trust, West Sussex, United Kingdom; University of Brighton, United Kingdom.

PURPOSE: The recruitment and retention crisis within British pharmacy services is recognized and is expected to worsen during the next 5 years. As retention is related to job satisfaction, a survey of job and career satisfaction of hospital pharmacists employed in the South Thames region of the United Kingdom was undertaken.
METHOD: A questionnaire which had been previously validated to quantify job and career satisfaction was circulated to 608 pharmacists. Responses were assessed using a 5-point Likert scale with 1 indicating the most

dissatisfaction. Scoring was reversed for negatively worded statements so that a high score denoted greater satisfaction.
RESULTS: Responses were received from 232 pharmacists (38%), of whom 174 were female. The median age range was 31-40 years and most (46%) were employed at a middle management grade. Sixty-eight percent of pharmacists were satisfied with their current job and 65% with their career. Highly significant relationships were identified between job satisfaction and company policies, job role, and supervision at work ($p<0.0001$). Career satisfaction was related to company policies, compensation practices, job role, and education and training ($p<0.001$).
CONCLUSIONS: The results of this study highlight the need for employers to ensure that pharmacists are maintained in challenging roles which optimize use of their knowledge and skills. These findings will be used in designing a recruitment strategy for hospital pharmacists.

146. Factors affecting United Kingdom hospital pharmacist adverse drug reaction reporting. *Dimah R. Sweis, B.S.*, Ian C.K. Wong, Ph.D.; University of Bradford, West Sussex, United Kingdom.

PURPOSE: 1) To determine the extent of adverse drug reaction (ADR) reporting by hospital pharmacists in the United Kingdom (UK), and 2) to identify the factors affecting hospital pharmacist reporting of ADRs.
METHODS: Pilot questionnaires were distributed to 50 hospital pharmacists. The modified questionnaires were then sent out to 546 hospital pharmacists (13% of the UK hospital pharmacist population), randomly selected by the Royal Pharmaceutical Society of Great Britain. Reminders were sent 1 month later. The results were analyzed using SPSS.
RESULTS: Three hundred thirty-eight (62%) pharmacists replied. However, 61 were unable to answer the questions due to various reasons. Therefore, 276 (51%) were included in the analyses (pilot questionnaires were not included). This represented 7% of the UK hospital pharmacist population. Of those who replied, 45% reported having seen an ADR within the last 6 months, of which 18% did not report the ADR to the Committee on Safety of Medicines or manufacturers. Only 8% had a written hospital policy regarding ADR reporting. However, 73% agreed that a hospital policy would encourage them to report ADRs. Of those with some formal training, 72% saw and reported ADRs, whereas only 56% of the pharmacists without formal training reported. Lack of time and lack of patient contact were also factors hindering ADR reporting.
CONCLUSION: Written hospital policy, formal training, and allocation of more time for ADR monitoring will improve hospital pharmacist ADR reporting.

147. Outcomes assessment of practice pharmacists in primary care. *Colin G. Adair, Ph.D.*, Dermot Smyth, B.S., Terence A. Maguire, Ph.D., Carmel M. Hughes, Ph.D., Heather M. Bell, Ph.D., James C. McElnay, Ph.D., Kathryn Turner, M.S., Brenda Bradley, Ph.D., Colin Fitzpatrick, M.B.; The Queen's University of Belfast, Belfast, Northern Ireland; Eastern Health and Social Services Board, Northern Ireland, United Kingdom.

PURPOSE: The cost of prescribing in primary care in the United Kingdom is increasing at an annual rate of 12.5%. On average, each general medical practitioner will spend £250,000 on medicines and the probable introduction of cash-limited prescribing in 1999 will further increase pressure to rationalize spending. As an initial step towards facilitating this, Health Boards provided funding for pharmacists to work with general medical practitioners for an initial period of 12 months. Twenty-two practice pharmacists were recruited in 1997 and the impact of their interventions on prescribing costs was evaluated after this period.
METHODS: Pharmacists participated in an initial training program after which they each worked with one of 22 medical practices. Their interventions were tailored to the needs of the practice in the areas of repeat dispensing protocols, formulary development, generic prescribing, medication review clinics, and formal analyses of prescribing data. Qualitative and quantitative strategies were used to analyze the interventions by practice pharmacists.
RESULTS: After a 12-month period, 48% of practices had repeat dispensing protocols in place, 40% developed practice formularies, 55% increased their generic prescribing, 36% had medication review clinics in place, and 32% undertook regular formal analyses of prescribing data.
CONCLUSIONS: The yearly increase in prescribing costs of the 22 practices were lower than a comparison group of 22 practices without a pharmacist, matched for patient population and number of medical practitioners. On a regional basis, these cost savings equate to £2 million annually.

148. Pharmaceutical care provision by community pharmacists in the United Kingdom: a comparison of two regions. Heather M. Bell, Ph.D., *James C. McElnay, Ph.D.*, Carmel M. Hughes, Ph.D.; The Queen's University of Belfast, Belfast, Northern Ireland, United Kingdom.

PURPOSE: The concept of pharmaceutical care has been adopted as the model for the future practice of pharmacy, both within hospital and community settings. Odedina and Segal previously measured pharmacists' efforts to provide pharmaceutical care to patients with chronic disease states using the Behavioral Pharmaceutical Care Scale (BPCS). The aim of this study was to determine the extent of pharmaceutical care provision within two regions of the United Kingdom (UK), Northern Ireland (NI) and Scotland.
METHODS: The BPCS was modified to ensure the questionnaire was applicable to the organization of pharmacy within the National Health Service in the UK. The questionnaire was posted to all community pharmacists in NI and Scotland.
RESULTS: The mean scores achieved by community pharmacists in NI and Scotland, respectively, were 74.68 ± 19.25 and 68.24 ± 19.11 (maximum achievable score = 160). Both sets of pharmacists performed better with regard to instrumental activities as opposed to activities directly related to patient care or referral and consultation activities. However, it is apparent that community pharmacists in NI and Scotland are providing different aspects of pharmaceutical care to different extents. This supports the results previously reported by Odedina and Segal for Florida pharmacists. The total pharmaceutical care score achieved was found to be significantly related to the staffing levels within the pharmacy with pharmacists working in pharmacies which employed multiple pharmacists achieving higher mean scores (one way ANOVA; $p<0.05$).
CONCLUSION: While community pharmacists are making efforts to practice some aspects of pharmaceutical care, the provision of this patient-oriented service has yet to become routine.

Psychiatry

150. Recruitment for clinical trials: a tertiary care psychiatric outpatient clinic's experience in recruiting for depression studies. *Philip D. Rolland, B.S.*, Anita Kablinger, M.D.; Louisiana State University Medical Center, Shreveport, LA.

PURPOSE: The purpose of this study was to examine the cost effectiveness of recruitment methods for psychiatric patients in two clinical studies for depression, and explore reasons patients were excluded from randomization into clinical trials.
METHODS: Data collection consisted of reports from a database of subjects that had phoned the psychopharmacology research clinic for information about participating in clinical drug studies. Financial information regarding advertising expenditures was analyzed from a report of psychopharmacology research clinic expenses obtained from the department of psychiatry.
RESULTS: For the period December 1997 to April 1998, a total of 355 attempted patient contacts were made. Of these, 183 (51.55%) were not screened, while 172 (48.45%) were screened. Of the 172 patients who were contacted and screened, 141 (81.98%) were screen failures. Reasons for exclusion included: 1) other excluding diagnoses (n=29, 20.57%); 2) drug or alcohol use (n=23, 16.31%); 3) comorbid exclusionary medical illness (n=21, 14.89%); 4) using exclusionary prescription medications (n=16, 11.35%); 5) not interested (n=11, 7.8%); 6) failure to show (n=9, 6.4%); 7) canceled (n=9, 6.4%); 8) unknown (n=9, 6.4%); 9) unable to contact (n=6, 4.3%); 10) no means of transportation (n=5, 3.6%); and 11) suicidal (n=3, 2.13%).
CONCLUSIONS: For each patient randomized into these two studies, expenses were as follows: television advertising, $602.87; newspaper advertising, $608.11; and radio advertising, $1045.50. Word of mouth and flyers produced higher screening rates and randomization than did radio advertising; therefore, efforts to expand and track these methods were increased.

151E. Strategies for switching from conventional antipsychotic drugs or risperidone to olanzapine. Bruce J. Kinon, M.D., Bruce R. Basson, M.S., Sandra K. Malcolm, B.S., *Virginia L. Stauffer, Pharm.D., BCPS*, Gary D. Tollefson, M.D.; Eli Lilly and Company, Indianapolis, IN.

Presented at the 11th European College of Neuropsychopharmacology, Paris, France, November 2, 1998.

Pulmonary

152E. Variability in albuterol delivery with Proventil® HFA and Ventolin® metered dose inhaler. *Ralph A. Lugo, Pharm.D.*, Jim Keenan, B.S., RRT, Robert M. Ward, M.D., John W. Salyer, B.S., RRT; University of Utah; Primary Children's Medical Center, Salt Lake City, UT.

Published in Resp Care 1998;43:831.

153E. Too low dosage of inhaled steroids among patients with long-acting β_2-agonists. *Charles M.J.M. Gerrits, Pharm.D.*, Henk Buurma, Pharm.D., Hendrik M. van Akkerveeken, Pharm.D., Oscar Kelder, Pharm.D., Clementine C.M. Stuijt, Pharm.D., Ron M.C. Herings, Pharm.D., Ph.D.; University of Utrecht, The Netherlands; Stevenshof Institute for Pharmacy Practice Research, Leiden, The Netherlands.

Presented at the 14th International Conference on Pharmacoepidemiology, Berlin, Germany, August 16-19, 1998.

154. Effects of inhaled fluticasone propionate on the intrahospital outcome of mechanically ventilated patients with chronic obstructive pulmonary

disease. *M.L. Compagnoni, Ph.D.*, S. Nava, M.D.; Centro Medico di Montescano, Montescano, Italy.

PURPOSE: Inhaled β_2-agonists are used to improve respiratory mechanics during mechanical ventilation. We have previously shown that intravenous methylprednisolone is useful in improving respiratory mechanics but may be associated with well-known side effects. Here we assessed the effects of fluticasone propionate (FP) on respiratory mechanics and on the clinical outcome of ventilated chronic obstructive pulmonary disease (COPD).
METHODS: In this case-control study, ten patients with COPD undergoing mechanical ventilation received 2 mg/die of (FP) from admission (baseline) and were compared with patients receiving only long-term β_2-agonists ($LT\beta_2$). Respiratory mechanics were assessed daily using end expiratory airway occlusion for recording static positive end expiratory pressure (PEEPi), and end inspiratory occlusion for recording static compliance and inspiratory resistances.
RESULTS: Both groups showed a significant improvement of respiratory mechanics starting from day 3. At the time of weaning, PEEPi was significantly reduced (4.3 ± 2.1 cm H_20 baseline, 2.0 ± 1.1 and 2.1 ± 1.2 for PF and $LT\beta_2$, respectively), as well as inspiratory resistance (19.9 ± 4.4 cm H_20/L/s baseline and 12.3 ± 3.8 and 11.0 ± 4.0 for PF and $LT\beta_2$, respectively). Static compliance did not show any significant changes. Two of ten patients in each group did not complete the weaning process within 21 days; one in each group died. Length of mechanical ventilation and intensive care unit stay were similar for the two groups (9 ± 6 days and 14 ± 8 for PF group; 10 ± 8 and 16 ± 6 for $LT\beta_2$). No major pharmacologic side effects were observed.
CONCLUSIONS: In these patients, FP use is associated with improved respiratory mechanics. The clinical outcomes (length of ventilation, mortality, and intensive care unit stay) were similar in the groups undergoing inhaled FP or $LT\beta_2$ treatment. FP may be used instead of systemic steroids and $LT\beta_2$ to improve respiratory mechanics and therefore providing better condition for weaning.

155E. Selection of clinical outcomes with the greatest statistical power for comparing the per microgram effectiveness (relative potency) of inhaled corticosteroid preparations. R. Ahrens, *M. Teresi*, B. Ekholm, S. Han, J.A. VandenBurgt, D. Donnell; University of Iowa, Iowa City, IA; 3M Pharmaceuticals, St. Paul, MN.

Presented at the World Asthma Meeting, Barcelona, Spain, December 10-13, 1998.

Rheumatology

156. Comparison of safety and efficacy between meloxicam and diclofenac in osteoarthritis patients. *May-Ying Hsu, M.S.*, Yea-Huei K. Yang, B.S., Chyun-Yu Yang, M.D., Kin-Wei A. Chan, M.D., Sc.D.; National Cheng Kung University Hospital, Tainan, Taiwan; National Taiwan University, Taiwan.

PURPOSE: Meloxicam, a new nonsteroidal antiinflammatory drug of the enolic acid class, has been approved in Europe since 1995. We compared the efficacy and safety between meloxicam and diclofenac in this clinical trial.
METHODS: In this prospective, double-blind, double-dummy, randomized, parallel-group clinical trial, patients received either meloxicam 7.5 mg with one diclofenac-placebo once daily or diclofenac slow release 100 mg with meloxicam-placebo once daily, according to the randomization scheme for 28 days. Main efficacy endpoints were final global assessment of efficacy, pain on active movement, pain at rest, change of arthritis condition, and withdrawal due to inadequate efficacy. Adverse events (AEs) in terms of incidence, intensity, causal relationship to the trial drugs, withdrawals due to AEs, change in laboratory values, and tolerability were main safety endpoints.
RESULTS: From October 1997 through May 1998, 343 patients were evaluated for study eligibility, of which 282 patients received trial medication (meloxicam 140, diclofenac 142). A total of 236 patients completed the trial (meloxicam 124, diclofenac 112). There was no difference between the two groups with respect to the efficacy variables. Significantly fewer gastrointestinal AEs were reported in the meloxicam group (40.0%) compared with the diclofenac group (54.23%; p=0.017; odds ratio 0.563). Discontinuation due to AEs was significantly lower in the meloxicam group (3.57%) than in the diclofenac group (11.97%; p=0.009; odds ratio 0.272).
CONCLUSIONS: Meloxicam 7.5 mg once daily was as effective as diclofenac 100 mg slow release in Taiwanese patients with acute symptomatic osteoarthritis. Meloxicam demonstrated a more favorable gastrointestinal tolerability when compared with diclofenac slow release.

Substance Abuse/Toxicology

157. Community pharmacy supervised methadone administration schemes in the United Kingdom. *Chris J. Cairns, M.S., M.R. Pharm.S.*, Julia Hender, B.A.; St. George's Hospital, London, United Kingdom; West Sussex Health Authority.

PURPOSE: Methadone substitution programs are used in the United Kingdom (UK) to minimize the spread of HIV, AIDS, and hepatitis, and to reduce narcotic use. "Leakage" of methadone has led to fatal and nonfatal incidents including inadvertent ingestion by addicts' children. This has led to supervised administration in community pharmacies at the time of dispensing for some clients. This extends community pharmacists' role in harm reduction while introducing training, funding, and quality issues.
METHODS: All Health Authorities (HAs, 119) in the UK were surveyed by post. The questionnaire contained open and closed questions on schemes and their characteristics.
RESULTS: Ninety (76%) responses were received. Twenty HAs (18%) had a scheme with 33 (28%) planning to introduce one. The number of pharmacies within an HA providing a service varied widely; mean 30 (± 34 SD). The proportion of pharmacies in an HA varied from 5% to 67% (median 22%). Activity data were available for ten HAs. Average monthly administrations per pharmacy was 163 (± 205 SD) with wide variation (0-1112). Client profile also varied, mean per pharmacy 11 (± 10 SD). Some pharmacies had up to 65 clients. Training was provided in 72% of schemes. An accreditation scheme was in place in eight instances. Only one-third of schemes met population needs, with the remainder of schemes underproviding the demand.
CONCLUSIONS: Supervised methadone administration schemes are rapidly expanding in the UK, but there is wide variation in activity.

158. Evaluation of bupropion for smoking cessation at a Veterans Affairs medical center. *Michelle T. Kelly, Pharm.D.*, Laurel Janney, Pharm.D.; Veterans Affairs Medical Center, Iowa City, IA.

PURPOSE: To evaluate the utilization and efficacy of bupropion to promote smoking cessation at a Veterans Affairs medical center. It was unknown whether the regimens prescribed, smoking cessation counseling provided, and efficacy were consistent with clinical trials.
METHODS: Retrospective review of 45 patients prescribed bupropion for smoking cessation was conducted. Medical records were reviewed to determine the regimens prescribed, smoking cessation counseling provided, and the number of patients abstinent at the end of treatment and 3 months following the end of treatment. Patients were contacted by telephone to obtain missing information.
RESULTS: Doses were between 150-300 mg per day in all but one case. Duration of therapy was less than 7 weeks in 24% of cases, 7-12 weeks in 53% of cases, and longer than 12 weeks in 24% of cases. Fifty percent of patients received some type of smoking cessation counseling. Sixteen of 45 patients discontinued bupropion early, six citing adverse reactions. At the end of treatment, 9 out of 45 patients were abstinent (20%). Follow-up abstinence rates will be presented.
CONCLUSIONS: Doses prescribed were consistent with regimens used in clinical trials, although length of treatment varied. More patients discontinued therapy early compared with clinical trials. Abstinence rates were substantially lower than reported in clinical trials. The lower success rate could be due to differences in prescribed regimens, less emphasis on smoking cessation counseling, and differences in the patient population. Prescribing guidelines and stringent counseling requirements have been proposed to increase the likelihood of success with this therapy.

159E. Poison center reported mortality data inconsistent with national trends. Jansje M. Hoppe, Pharm.D., *Larry M. Lloyd, Pharm.D., MBA*, Peter A. Chyka, Pharm.D.; University of Tennessee, Memphis, TN.

Published in Clin Toxicol 1998;36:500.

160E. Drugs and suicide attempts in Benin City, Nigeria from 1991 to 1995. *L.O. Agada, M.S.*, A.E. Eferakeya, Ph.D.; University of Benin, Benin City, Nigeria.

Presented at the 24th Annual Regional Conference of the West African Society of Pharmacology, Sokoto State, Nigeria, October 24, 1997.

Transplantation

161. OKT3-induction therapy and early steroid discontinuation in heart transplant patients. *Jeffrey A. Haroldson, Pharm.D.*, Kathleen D. Lake, Pharm.D., Robert W. Emery, M.D., Marie-Teresa Olivari, M.D., Marc R. Pritzker, M.D.; Abbott/Northwestern Hospital; Minnesota Heart Institute Foundation, Minneapolis, MN.

PURPOSE: Long-term corticosteroid-induced complications may result from standard triple-drug immunosuppression (TDI). Patients at high risk (diabetes, less than 21 years, renal insufficiency, female, mechanical assist devices) for complications from TDI were selected to receive an OKT3-induction protocol in addition to TDI to allow for early aggressive steroid withdrawal.
METHODS: From May 1987 to May 1997, 112 high-risk patients received the OKT3-induction protocol post-transplant. Exclusion from early death (greater than 6 months) and nonadherence to the protocol left 83 patients for analysis. By 6 months post-transplant, group 1 patients were successfully

withdrawn from steroids; group 2 patients were not withdrawn.
RESULTS:

	Group 1 (n=57)	Group 2 (n=26)	p value
Follow up (months) †	69 ± 36	70 ± 36	NS
Age at transplant (years)†	48 ± 16	53 ± 12	NS
Rejection free	40 (70%)	2 (8%)	<0.05
Rejections/patient†	0.3 ± 0.5	2.2 ± 1.7	<0.05
First rejection (days)†	411 ± 792	184 ± 209	<0.05
Pre-transplant weight (kg)†	71.3 ± 17	71.2 ± 14.5	NS
Weight 5 years post-transplant (kg)†	81 ± 18	79.8 ± 17.3	NS
Cholesterol 5 years post-transplant (mg/dl)†	191 ± 70	195 ± 57	NS
Triglycerides 5 years post transplant (mg/dl)†	192 ± 112	190 ± 121	NS
Lymphoproliferative disease	0	0	NS
Hypertension	46 (79%)	20 (77%)	NS
Graft coronary disease	17 (29%)	10 (38%)	NS
Serum creatinine (mg/dl)†	1.6 ± 0.3	1.7 ± 0.4	NS
Pre-transplant diabetes	12 (21%)	7 (27%)	NS
New onset diabetes	2 (4%)	2 (8%)	NS
Infections	13 (23%)	10 (38%)	NS
5 year actuarial survival	92%	80%	0.23

†mean ± SD

CONCLUSIONS: Unsuccessful steroid withdrawal early post-transplant in high-risk patients is not associated with increased complications secondary to long-term corticosteroid use. Early aggressive steroid discontinuation may not be warranted in high-risk patients having early and frequent rejection episodes.

162. Cyclosporine-methylprednisolone interaction resulting in discrepancy between high pressure liquid chromatography and monoclonal fluorescent polarization immunoassay concentrations in lung transplantation. *Marcus T. Haug, Pharm.D., M.S.*, Sophie Wimberley, Pharm.D., Janet Maurer, M.D., Atul Mehta, M.D., Alex Arroliga, M.D.; The Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: This study documents the observed changes in cyclosporine concentrations analyzed by high pressure liquid chromatography (HPLC) or monoclonal fluorescent polarization immunoassay (MFPIA) when high dose methylprednisolone is administered for acute rejection in lung transplant patients receiving oral or intravenous cyclosporine.
METHODS: Cyclosporine assay methodology was changed from HPLC to MFPIA at our institution. The study included 15 lung transplant patients stable on cyclosporine who received methylprednisolone 500-1000 mg intravenously for documented or suspected lung rejection. Initially, seven patients were studied using the HPLC method, and an additional eight were later evaluated with the MFPIA assay. Analysis of cyclosporine levels was completed with oral or intravenous infusion cyclosporine after methylprednisolone administration.
RESULTS: A total of 43 cyclosporine levels were analyzed for patients receiving oral cyclosporine (12 HPLC, 31 MFPIA). Methylprednisolone reduced HPLC cyclosporine pre-levels from 305 ± 92 ng/ml to 189 ± 82 ng/ml (p=0.045). Methylprednisolone increased MFPIA cyclosporine pre-levels from 394 ± 133 ng/ml to 535 ± 169 ng/ml (p=0.017). With intravenous cyclosporine, 27 levels were measured (20 HPLC, 7 MFPIA). Methylprednisolone decreased cyclosporine levels with HPLC assay from 310 ± 40 ng/ml to 293 ± 40 ng/ml (p=0.345), and with MFPIA assay, cyclosporine levels were increased from 434 ± 4 ng/ml to 479 ± 45 ng/ml (p=0.148).
CONCLUSIONS: The oral cyclosporine-methylprednisolone interaction is more pronounced than the intravenous cyclosporine-methylprednisolone interaction. Oral dosage adjustments of cyclosporine would be discordant based on the assay used to analyze cyclosporine concentrations after methylprednisolone. This interaction results in opposite changes in cyclosporine concentration by two common assay methods.

163. The influence of menopause on the HPA axis response in renal transplant recipients receiving chronic glucocorticoids. *Andrea M. Ciminelli, Pharm.D.*, Kris A. Reed, B.S.N., Mahfooz Farooqui, M.D., Rocco C. Venuto, M.D., Kathleen M. Tornatore, Pharm.D.; State University of New York at Buffalo; Erie County Medical Center, Buffalo, NY.

PURPOSE: The population of renal transplant recipients (RTR) over 50 years old is rapidly increasing. There are no pharmacodynamic data describing the influence of post-menopausal state on the HPA axis response to glucocorticoid therapy in RTR. The purpose of this study was to describe the pharmacodynamic response of the HPA axis to methylprednisolone (MEPN) in post-menopausal RTR compared to previously evaluated males.
METHODS: Eight post-menopausal RTR (ages 40 to 69 years) with stable creatinine clearance (CrCl) of 54.7 ± 21.6 ml/min receiving MEPN (mean dose 6.3 mg) were evaluated during a 24-hour study. Serial blood samples were collected after a 20-30 minute IV infusion of MEPN and compared to 17 male RTR (CrCl = 81.4 ± 20.4 ml/min; mean MEPN 11.4 mg/day). Cortisol samples were analyzed by HPLC with ACTH determined by an immunoradiometric assay. Total 24-hour hormone exposure was quantitated by AUC values with WINNONLIN.
RESULTS: Defined 24-hour cortisol patterns were noted in 5/9 females with a mean 8 a.m. cortisol concentration of 103.4 ng/ml. Cortisol declined monoexponentially reaching a nadir of less than 10 ng/ml in both groups. Cortisol 24-hour AUC in the female group (552 ± 385 ng·hr/ml) was not significantly different compared to the males (591 ± 393 ng·hr/ml). Cortisol patterns were suppressed in 3/8 females with baseline cortisol less than 30 ng/ml. The 8 a.m. ACTH concentrations ranged from 10 to 50 pg/ml (normal for healthy volunteers) with diurnal patterns in 4/8 women. ACTH 24-hour AUC was 226 ± 77 pg·hr/ml for the group. No significant correlations were determined between the demographics and pharmacodynamic responses.
CONCLUSION: In contrast to the clinical assumption of suppressed HPA axis activity in RTR receiving MEPN, this study found pronounced intrapatient variability in ACTH and cortisol secretion regardless of age or gender. The considerable variation in total glucocorticoid exposure (cortisol and MEPN) may have a significant clinical impact on the development and treatment of steroid complications (e.g., osteoporosis, diabetes).

164. The HPA axis response to chronic glucocorticoid therapy in female renal transplant recipients. *Kristin K. Gilliland, Pharm.D.*, Kris A. Reed, B.S.N., Mahfooz Farooqui, M.D., Rocco C. Venuto, M.D., Kathleen M. Tornatore, Pharm.D.; State University of New York at Buffalo; Erie County Medical Center, Buffalo, NY.

PURPOSE: No pharmacodynamic data are available describing the impact of gender on the HPA response to glucocorticoid therapy in renal transplant recipients (RTR). The purpose of this study was to describe the pharmacodynamic response of the HPA axis to methylprednisolone (MEPN) in female RTR compared to previously studied male counterparts.
METHODS: Thirteen female RTR (ages 30 to 49 years) with stable creatinine clearance (CrCl) of 51.7 ± 21.3 ml/min in the luteal phase receiving MEPN (mean dose 7 mg) were evaluated over 24 hours. Serial blood samples were collected after a 20-30 minute IV infusion of MEPN. This group was compared to 16 male counterparts (CrCl of 81.4 ± 20.4 ml/min; mean MEPN 11.4 mg/day). Cortisol was analyzed by HPLC with ACTH determined by an immunoradiometric assay. Hormone exposure was quantitated by AUC values with WINNONLIN.
RESULTS: A defined 24-hour cortisol pattern was noted in 9/13 females with a mean cortisol concentration at 8 a.m. of 111.2 ng/ml. Cortisol declined monoexponentially reaching a nadir of less than 10 ng/ml in both groups. Cortisol 24-hour AUC in the female group (575 ± 318 ng·hr/ml) was not significantly different (p=0.599) compared to the males (591 ± 393 ng·hr/ml). Four females had suppressed cortisol patterns consistent with HPA axis suppression. ACTH concentrations at 8 a.m. in 12/13 women ranged from 10-50 pg/ml (normal limits for healthy volunteers). ACTH 24-hour AUC was 299 ± 102 pg·hr/ml for females, with blunted 24-hour ACTH patterns in the four women with suppressed cortisol response. No significant correlations were determined between patient demographics and pharmacodynamic responses.
CONCLUSION: This pharmacodynamic study contradicts the clinical assumption of suppressed HPA axis activity during chronic glucocorticoid therapy. These data also suggest that intrapatient variability in cortisol exposure may impact upon the development of important chronic adverse effects in women such as osteoporosis.

165E. Pharmacologic variability of every other day glucocorticoid therapy in renal transplant recipients. *Kathleen M. Tornatore, Pharm.D.*, Kris A. Reed, B.S.N., Rocco C. Venuto, M.D.; State University of New York at Buffalo; The Erie County Medical Center, Buffalo, NY.

Presented at the 17th Annual Meeting of the American Society of Transplant Physicians, Chicago, IL, May 9-12, 1998.

166E. Randomized comparison of ampicillin/sulbactam versus ampicillin plus cefotaxime for bacterial prophylaxis after orthotopic liver transplantation. *Theodore Sievers, Pharm.D.*, Curtis D. Holt, Pharm.D., Drew J. Winston, M.D., Ronald W. Busuttil, M.D., Ph.D.; Cedars-Sinai Medical Center; UCLA Medical Center, Los Angeles, CA.

Presented at the 38th Interscience Conference on Antimicrobial Agents and Chemotherapy, San Diego, CA, September 27th, 1998.

167E. P-glycoprotein is responsible for drug elimination in peripheral T cells from solid organ and stem cell transplant recipients. Vera S. Donnenberg, M.S., Deborah L. Griffin, B.S., *Gilbert J. Burckart, Pharm.D.*, Ashok B. Jain, M.D., Albert D. Donnenberg, M.D.; University of Pittsburgh, Pittsburgh, PA.

Presented at the Transplant Society XVII World Congress, Montreal, PQ, Canada, July 12-17, 1998.

168. Post-liver transplant immunoprophylaxis with hepatitis B immunoglobulin using a titer-based dosing protocol. *Kirsten L. Chapman, Pharm.D.*, Anthony Sebastian, M.D., Bakr Nour, M.D.; Integris Baptist Medical Center, Oklahoma City, OK.

PURPOSE: Current literature supports use of hepatitis B immune globulin (HBIG) for long-term passive immunoprophylaxis against hepatitis B virus (HBV) after orthotopic liver transplantation (OLT). We implemented a titer-based HBIG dosing protocol to decrease cost associated with HBIG immunoprophylaxis and maintain adequate hepatitis B surface antibody (HBsAb) titers to prevent HBV reinfection.
METHODS: A titer-based HBIG dosing protocol to maintain HBsAb titers greater than 150 IU/L day 0-6 after OLT was instituted July 1997. All patients who underwent OLT for hepatitis B were evaluated. Patients transplanted prior to implementing the dosing protocol represented historical controls and received standard HBIG dosing. These patients were compared to patients who received HBIG dosing based on daily HBsAb titers.
RESULTS: Fifteen patients were transplanted for hepatitis B between June 1993 and July 1998. Group 1 (n=8) included patients transplanted prior to protocol implementation. Each of these patients received seven doses of HBIG. Group 2 (n=7) consisted of patients transplanted after July 1997; they received a mean of 4.9 (range 3-7) HBIG doses. A 30% reduction in HBIG doses was seen in group 2 (p=0.01) resulting in a decrease in drug acquisition cost of $7140 per patient. Both groups maintained HBsAb titers greater than 150 IU/L at 1 month post-transplant without additional HBIG dosing.
CONCLUSIONS: Based on preliminary results, it is cost effective to utilize titer-based dosing for administration of HBIG during the immediate postoperative period after OLT. Long-term follow up is necessary to validate efficacy in terms of HBV reinfection rates.

169. Nephrotoxicity of amphotericin B lipid complex in bone marrow transplant patients receiving cyclosporine. *Jennifer Strickland, Pharm.D.*, Gary Yee, Pharm.D., John Lister, M.D., Lily Lee, Ph.D., John Wingard, M.D.; H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL; University of Nebraska, Omaha, NE; University of Pittsburgh, Pittsburgh, PA; The Liposome Company, Princeton, NJ; University of Florida, Gainesville, FL.

Amphotericin B deoxycholate (AMB) is widely used to treat suspected or documented fungal infections. However, efficacy is often limited due to dose-limiting nephrotoxicity, which can be particularly problematic in patients undergoing allogeneic bone marrow transplantation (BMT) who receive cyclosporine (CYA). Amphotericin B lipid complex (ABLC) is a liposomal formulation of AMB that is associated with less nephrotoxicity as compared with AMB. We compared the incidence of nephrotoxicity of ABLC versus AMB in 126 patients undergoing allogeneic BMT who received CYA. Data were collected prospectively from open-label multicenter clinical trials of ABLC (n=63) and retrospectively from medical records of patients treated with AMB (n=63) at five BMT centers. Age, gender, and underlying disease were comparable in the two groups, but mean baseline serum creatinine was higher in ABLC-treated patients. ABLC-treated patients had no significant changes in baseline serum creatinine (mean difference -0.21 to 0.009 mg/dl) during the duration of treatment. However, significant increases in serum creatinine were consistently observed in AMB-treated patients (mean difference 0.26 to 0.49 mg/dl). Furthermore, a greater proportion of ABLC-treated patients had either stable or improved serum creatinine as compared with AMB-treated patients. These data show that ABLC can be safely administered to patients undergoing allogeneic BMT who receive CYA. Further studies are necessary to determine the role and cost effectiveness of ABLC as first-line therapy in patients with pre-existing renal dysfunction or who receive concomitant nephrotoxic drugs.

Women's Health

170. Patient decisions and attitudes regarding self-treatment with nonprescription vaginal products and comparisons of self, physician, and laboratory diagnoses. *Janet McCombs, Pharm.D.*, William J. Spruill, Pharm.D.; University of Georgia, Athens, GA.

PURPOSE: To assess patient factors and attitudes influencing decisions to use a nonprescription vaginal product and to compare self, physician and laboratory diagnoses.
METHODS: One hundred nine patients agreed to collection of a vaginal discharge sample for microscopic evaluation by a microbiology laboratory. The patient's self-diagnosis, the physician's presumptive diagnosis, and the laboratory diagnosis were compared. Patients completed a questionnaire about factors influencing decisions to self-treat, product choice, and attitudes concerning pharmacist interventions about gynecologic problems. Patients were also asked if they read the indication on the product about appropriate use and were asked to summarize it.
RESULTS: Fifty-six patients self-treated. Only 29 had a physician or laboratory diagnosis of yeast, the remaining 27 had infections other than yeast or no infection. Of the 53 who did not self-treat, 16 had a physician or laboratory diagnosis of yeast. Although most patients did not ask advice from a pharmacist, they would prefer a young female or older male pharmacist and their regular pharmacist. Of the 34 patients who said that they read the indication, only six were able to recall it correctly.
CONCLUSIONS: Patients who self-treated were about 50% accurate in predicting a yeast infection, while about 30% of the patients who did not self-treat had yeast. Most of the women were unwilling to seek advice from male pharmacists but would prefer gynecologic advice from younger female pharmacists and pharmacists who knew them well. Lastly, most women did not use the product indication as a guide to self-treatment.

171E. Characterization of 17-β estradiol biosynthesis in ED_{27} human trophoblasts isolated from first trimester chorionic villi. *Patty Fan-Havard, Pharm.D.*, Jessica L. Park, Pharm.D., Craig S. Park, Pharm.D., Douglas A. Kniss, Ph.D.; The Ohio State University, Columbus, OH.

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DOCUMENTING THE VALUE OF CLINICAL PHARMACY SERVICES

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

172. Pharmacy-led clinical audit as a tool to improve the use of antiplatelet and anticoagulant therapy in patients with nonrheumatic atrial fibrillation. Anne Cummins, B.Pharm., M.R.Pharm.S., C. Alice Oborne, M.Sc., M.R.Pharm.S., *Duncan McRobbie, M.Sc., M.R.Pharm.S.*; Guy's and St. Thomas' Hospital Trust; Kings College School of Medicine and Dentistry, London, United Kingdom.

PURPOSE: Atrial fibrillation (AF) is one of the more common sustained arrhythmias. The number of these patients aged over 65 years in the United Kingdom is estimated to be between 160,000 and 644,000. Trials published over recent years have demonstrated that dose adjusted warfarin is superior to higher dose aspirin (300 mg/day) at reducing the risk of thromboembolic stroke in patients with nonrheumatic AF. Low dose aspirin was found to be ineffective. This audit was carried out to assess anticoagulant and antiplatelet prescribing in patients with nonrheumatic AF on three separate occasions at St. Thomas' Hospital.
METHODS: Previous work has identified antithrombotic prescribing guidelines in AF based on the published literature. Patients with a definite diagnosis of atrial fibrillation were identified on three separate occasions. Prescriptions for anticoagulant or antiplatelet therapy and any contraindications to warfarin or aspirin were noted. Feedback to medical staff included review of the published trials, guidelines for appropriate therapy, and results. This was reinforced via the clinical pharmacy service.
RESULTS: There was a progressive increase in the prescribing of dose adjusted warfarin or aspirin 300 mg. Prescribers still tended to use low doses of aspirin of unproven efficacy.

	First Audit		Second Audit		Third Audit	
	No. patients	%	No. patients	%	No. patients	%
Definite diagnosis of AF	21		19		66	
Warfarin or aspirin indicated	17	100	9	100	64	100
Warfarin or aspirin 300 mg	3	18	4	44	33	52
Lower aspirin dose (75-150 mg)	5	29	5	55	31	48
Not on aspirin or warfarin	9	53	0	0	0	0

CONCLUSION: Pharmacy-led clinical audits can improve the use of antiplatelet and anticoagulant therapy in patients with nonrheumatic atrial fibrillation.

173. A randomized multicenter study evaluating the impact of clinical pharmacist services on resource utilization for patients at high risk for drug-related problems: the IMPROVE study. *Daniel C. Malone, Ph.D.*, Barry L. Carter, Pharm.D., Sarah J. Billups, Pharm.D., the IMPROVE investigators; University of Colorado Health Sciences Center; Kaiser Permanente, Denver, CO.

The purpose of this study was to examine the impact of clinical pharmacists on resource utilization for patients at high risk for drug-related problems. This study involved nine Veterans Affairs medical centers. Patients were enrolled if they met three of six criteria for being at high risk for drug-related problems. Patients were randomized to usual care (control) or to pharmaceutical care (intervention) provided by ambulatory clinical pharmacists. Data on clinic visits, hospitalizations, laboratory tests, medications, and imaging procedures were collected over a 2-year period, 1 year before and after enrollment. A total of 1059 patients were enrolled into the study, 531 control and 525 intervention patients. The mean number of clinic visits increased from 18 at baseline to 24 for the control group and from 20 to 26 for the intervention group, but these differences were not statistically significant (t-test = 0.80, p=0.42). Likewise, there was no difference in the number of imaging procedures (t-test = 0.64, p=0.52). The mean cost of laboratory tests went from $264.49 to $379.45 in the control group. The mean cost of labs in the intervention group also rose, but only $67.23, from $311.86 to $379.11. The difference over time was not statistically significant (t-test = 1.11, p=0.26). Analysis of medication use and hospitalizations is underway and will be presented. The results suggest that

clinical pharmacists have no effect on the number of clinic visits, imaging procedures, or laboratory costs in patients at high risk for drug-related problems.

174. Documentation and reimbursement of pharmaceutical care activities in an outpatient clinic pharmacy. *Carrie J. Boeckelman, B.S.*, Lynnae M. Mahaney, MBA; UW Health Physicians Plus Pharmacy, Madison, WI.

PURPOSE: This study documented the daily pharmaceutical care activities of clinical pharmacists. A dollar value was assigned to each activity, which provided a mechanism for seeking third party reimbursement and assessing pharmacist value.
METHODS: A tool was developed to allow pharmacist documentation of pharmaceutical care activities within their daily work flow. This study was conducted over a 6-month period. The documentation was compiled at the central business office biweekly and was subsequently reviewed and submitted for third party reimbursement. In addition, this tool was used to document the pharmacists' financial value to the health care system.
RESULTS: Each of the documented interventions was assigned a monetary savings based on the Wisconsin Medicaid Pharmaceutical Care Program. This allowed the pharmacy department to calculate an overall cost savings. The monetary calculations and savings will be provided in detail. Second, the tool allowed for the centralized billing and subsequent reimbursement of pharmaceutical care services by three third party payers. This reimbursement data will be provided in detail.
CONCLUSION: Outpatient pharmacists routinely perform value added functions beyond traditional product dispensing, yet many third party payers have failed to recognize the value of these services due to the pharmacy's inability to provide documentation. In this study, a tool is developed and implemented for that documentation and subsequent reimbursement of pharmaceutical services. Use of this tool has been a successful means of documenting pharmacists' activities within daily work flow. In our department, we plan to continue using this tool and are confident it could be applied in a variety of other settings with the same success.

175. Can a pharmacist-managed anticoagulation clinic be cost justified via traditional means of revenue generation and labor shifting rather than solely by an improvement in patient care? *Rebecca J. Millan, Pharm.D.*, Elise Marion, Pharm.D., Mark E. Chaparro, Pharm.D., Tom Thompson, B.S., Pam B. Ailstock, Pharm.D., Steve O. Price, Pharm.D., BCPS; NorthEast Medical Center, Concord, NC.

PURPOSE: Pharmacist-managed anticoagulation clinics (RPh-AC) have traditionally been justified by demonstrating a reduction in adverse events related to anticoagulation (AC). Our goal was to justify a RPh-AC based on revenue earned from billing, costs avoided by labor shifting, and improved quality of care.
METHODS: The RPh-AC was established in a medical practice employing six physicians. Pre-RPh-AC, laboratory technicians (LT) obtained international normalized ratios (INRs), and all dosage instruction and patient follow up was conducted via telephone by physicians and nurses. In the RPh-AC, INRs are obtained by the pharmacist using Coaguchek2®, then adjusted per protocol; patients are assessed for complications and compliance, and a return visit is scheduled. Monthly, an office visit (CPT 99211) is charged under the physician provider number; all visits are charged an INR. Cost-analysis was based on total expenses, revenues earned, and associated cost-avoidance (ACA). ACA was obtained from shifting labor costs previously incurred by other personnel to the pharmacist. To assess the quality of care of the RPh-AC, 6 months of data were compared to the preceding 6 months of standard care. Data included percentage of patients therapeutic, average number of visits per month, assessment of compliance, and patient satisfaction.
RESULTS: Cost analysis of RPh-AC revealed expenses exceeded revenue by $10,151 and by $26,227 during the pre-RPh-AC period. Net cost-avoidance based on supplies, personnel time previously spent on AC, and miscellaneous expenses resulted in a cost-avoidance of $16,076 per year for RPh-AC.

Financial	Pre RPh-AC	RPh-AC
Revenue ($)	40,498	100,436
Expenses ($)		
MD	21,480	na
RN	6,444	na
LT	8,592	na
Rph	na	56,495
Lab supplies	26,549	26,549
Contractual adjustment	na	27,540
TOTAL	63,065	110,584
Revenue > Expense ($)	-26,227	-10,151
Net Cost Avoidence ($)	None	16,076
Clinical Results		
Patients	210	252
Therapeutic INR ± 0.2	69.67%	71.13%
Average visits per month	358.8	389.2
Average visit per patient per month	1.7	1.5**
Patients non-compliant*	73	1
Survey Results (35% responded)		
Confused about dose	60%	1.6%
Preferred method of care	1.6%	98.4%
Increased comfort and knowledge of AC therapy	na	94%
Comfort with RPh	na	97%

*missed at least 50% of appointments more than 7 days; **decreased 2.4 visits per patient per year

CONCLUSION: The RPh-AC generates revenue, decreases personnel, and improves quality of patient care. Through this, administration has deemed the RPh-AC cost-justified, and the physician practice will continue to cover all expenses of the RPh-AC. The RPh-AC will further assess quality improvement through chart reviews to determine a change in adverse events related to AC therapy.

176. A tracking system to justify clinical pharmacy services, evaluate practitioners, and promote clinical pharmacy services. *Frank M. Butler, Pharm.D., BCPS*; Michael Reese Hospital and Medical Center, Chicago, IL.

PURPOSE: A tracking system was developed to add accountability to the clinical staff and provide an objective scale to evaluate performance. In addition, data justifying and marketing clinical pharmacy services were available for presentation to hospital administrators and physicians.
METHODS: A spreadsheet was developed to incorporate productivity data into a usable format. The spreadsheet included, for each clinical specialist, a monthly tally of the following: interventions, renal dosing adjustments, discontinuing medications, change in therapy, intravenous to oral conversions, in-services, residents and students on service, and the number of reported adverse drug reactions. An in-house audit was conducted to assign average cost savings to the selected intervention categories. In addition, cost savings from an assigned cost containment project were recorded in the spreadsheet. Lastly, cost avoidance data were added from the aminoglycoside program using pre-service and post-service toxicity rates and using literature on the cost of aminoglycoside toxicity. Each month the data were analyzed and shared with the practitioner and hospital administrators.
RESULTS: Data revealed a value of $120,000 per practitioner in combined cost reductions, revenue generation, and cost avoidance. These data were used in clinical evaluations, and as an ongoing justification of the pharmacy services. A quarterly report summarizing the clinical services provided to individual services is used to market and make physicians aware of the scope of services provided by clinical pharmacists.
CONCLUSION: The aforementioned tracking mechanism can be a useful tool to justify and market clinical pharmacy services, as well as evaluate and measure performance of individual practitioners.

177. Creation of an independent provider association of pharmacists who provide clinical pharmacy services, a review of the process and benefits: the Greensboro experience. The Greensboro IPA Charter Committee, *Christopher M. Rubino, Pharm.D.*, Michelle Bozovich, B.S., Brian Bray, B.S., Frank Burton, B.S., Teresa Devora, B.S., Chris Dooley, B.S., Jean Douglas, Pharm.D., Pam Earnhardt, B.S., Larry Long, B.S., Peter Gal, Pharm.D.; Greensboro Area Health Education Center, Greensboro, NC.

BACKGROUND: Physician practices have formed collaborative business entities to facilitate managed care contracts. Pharmacists seeking to provide clinical pharmacy services and obtain reimbursement have typically worked independently. This report describes the formation of an independent provider association (IPA) by pharmacists practicing in separate business entities representing community (chain and independent), long-term care, hospital, industry, and education settings.
PURPOSE: To create a business entity which will encourage utilization and reimbursement of pharmacists for provision of cognitive services; to improve the continuity of pharmaceutical care as patients transition to different settings for health care.
METHODS: Approximately 30 pharmacists expressed interest in forming an IPA. Subcommittees were formed to gather information and set direction to several important issues including: creation of a business plan, formation of demonstration products to market to payors, establishment of standards and credentialling for providers (e.g., disease management certification), standardization of information technology (for communication and documenting outcomes), and formation of a technician subcommittee to advance technician roles so pharmacists can provide more clinical services. A subgroup of ten individuals were then elected by the entire group to work with an attorney experienced in forming physician networks to create the new pharmacy IPA.
RESULTS: An appropriate law firm has been identified and retained. The target date for incorporation is January 1999. Preliminary meetings with several physician groups including the local medical society has resulted in considerable physician support.
CONCLUSION: This model strengthens pharmacy practice within our region. It allows creation of clinical practice standards which promote endorsement by physician groups, thus improving our professional standing and increasing the likelihood of reimbursement.

178. Documentation of pharmaceutical care in the health care record. *Myrella T. Roy, Pharm.D., FCCP*, Céline Corman, M.S., Claire Laframboise, D.P.H., Lisa Rambout, B.Sc.Phm., Tim Veregin, B.S.P.; Ottawa Hospital, Ottawa, ON, Canada.

PURPOSE: To describe the conception and implementation of a systematic, standardized method for recording the pharmacist's daily pharmaceutical care activities in the patient's health care record.
METHODS: In 1989, sensing a growing need for continuity of care, accountability for outcomes, quality assurance, and liability management, we sought authorization for documenting pharmaceutical care in the patient health care record. The medical advisory committee first clarified that allied health professionals and physicians should write their notes on separate documents. After conducting a pilot project to test two formats of a documentation form, the final draft, using a 13-code system for time efficiency, was implemented in 1991 as an integral and permanent component of the health care record. Policy and procedures were established requiring pharmacists to document all suggestions, actions, and interventions intended to optimize patient pharmacotherapy, whether implemented or not.
RESULTS: After an adaptation phase, our pharmacists now advocate the indispensable value of formative documentation for the internal continuity of pharmaceutical care. Seven years later, the form, as well as the policy and procedures, have been expanded in format to 24 action codes and in content requirements. Documentation in the health care record has since been coupled to a workload database of pharmacy activities. Between April and September 1998, the pharmacists have monitored the pharmacotherapy on 14,448 patient-days and documented 13,888 interventions. The form has served as a tool for seamless care upon patient transfer to other facilities, quality assurance on in-house continuity of care, and defense evidence in a lawsuit.
CONCLUSIONS: Systematic documentation of pharmaceutical care in a standardized format has benefited the patient, the pharmacist, and the health care system.

179. Clinical and economic impact of a community pharmacist-managed lipid clinic in a cardiologist practice. Michelle Bennett Bozovich, B.S., *Christopher M. Rubino, Pharm.D.*, John H. Edmunds, M.D., Peter Gal, Pharm.D., Drug Therapy Management, Inc.; Greensboro Area Health Education Center; University of North Carolina; Eagle Cardiology Group, Greensboro, NC.

PURPOSE: To evaluate the benefits of a pharmacist-managed lipid clinic in a cardiologist office.
METHODS: A community pharmacist was contracted by a local cardiologist to initiate a lipid management clinic. Pharmacist reviewed all active patients within the cardiologist practice and identified patients requiring lipid-lowering intervention for secondary prevention of cardiovascular disease. These patients were entered into a database (Merck Win Pts Software) and then scheduled for clinic appointments with the pharmacist or drug therapy interventions were made directly from chart review. The cardiologist approved and signed a pharmacist-developed protocol allowing the pharmacist to make all necessary changes to drug regimens and order appropriate tests. Follow-up lipid profiles were obtained every 4-6 weeks until patients achieved their NCEP goal (£ 100 for all patients enrolled). Additional laboratory tests to monitor liver toxicity or secondary causes for lipid abnormalities were also ordered when appropriate. Compliance with laboratory lipid profiles was also measured.
RESULTS: At the end of 6 months, 184 patients were entered in the lipid clinic. Each patient had at least two follow-up lipid profiles. At enrollment, 36% of clinic patients were at goal. At the time of data analysis, 86% of patients were at goal. Two months after clinic initiation, compliance with scheduled laboratory lipid profiles increased 1400%. Currently there are 220 patients entered in the clinic. An analysis is planned to measure economic and clinical benefit based on extrapolation of numbers needed to treat to avoid complications of hyperlipidemia in a secondary prevention cohort.
CONCLUSIONS: A pharmacist-managed lipid clinic is clinically and economically justified. This clinic may serve as a model for community pharmacists contracting with physicians in a managed care environment to the benefit of all parties.

180. Managing congestive heart failure: an outcomes-based pharmacy-managed clinic. David J. Frohnapple, Pharm.D., BCPS, BCNSP, *Kathleen C. Findley, Pharm.D.*, Lisa K. Boggs, Pharm.D.; Veterans Affairs Medical Center, Gainesville, FL.

Despite significant advances, morbidity and mortality remain high in patients with congestive heart failure (CHF). Carvedilol, a non-selective β-adrenergic receptor antagonist with alpha-1 receptor blocking activity, has been shown to reduce symptoms, improve left ventricular function (LVF), and increase functional capacity in CHF. Carvedilol must be used in a specific patient population and requires cautious titration and monitoring. In November 1997, we established a pharmacy-managed clinic to identify and enroll patients who might benefit from carvedilol. Patients were selected from those referred from the cardiology clinic because of suboptimal response to conventional CHF therapy. Once patients were optimized on diuretics and angiotensin converting enzyme inhibitors or angiotensin receptor antagonists, carvedilol was initiated, and patients were monitored for outcomes. Patients received a baseline chest x-ray, echocardiogram, ECG, review of pharmacotherapy, and thorough clinical evaluation. Assessment of educational needs, provision of intensive patient education, and compliance with lifestyle modification and pharmacotherapy were priorities. Carvedilol was titrated to the maximum tolerated dose (up to 100 mg daily) over several months. In-depth electronic progress notes documented each clinic visit. Outcomes assessed included improvement in CHF signs and symptoms, improved ejection fraction, patients' perception of quality of life, and patients' satisfaction with our service as determined by patient surveys. Preliminary evaluation revealed most patients tolerate carvedilol, but tolerance is variable and highly dependent on comorbidities. Repeat echocardiograms at 6 months demonstrated significant improvement in LVF. Patients report improved exercise tolerance, and patients value the service provided in this clinic.

181. Impact of the cost of prescription drugs on clinical outcomes in indigent patients with heart disease. *Robert J. DiDomenico, Pharm.D.*, Marieke D. Schoen, Pharm.D., BCPS, Sharon Connor, Pharm.D., Jerry L. Bauman, Pharm.D., FCCP, BCPS; University of Illinois at Chicago, Chicago, IL.

PURPOSE: We have previously shown that economic relief to indigent patients with cardiovascular (CV) disease improves medication compliance. The purpose of this study was to measure the impact of this service on indicators of clinical outcomes in these patients.
METHODS: Eighty-four patients were enrolled in a pharmacist-managed prescription drug procurement service (PDPS) and four outcome measures were analyzed: international normalized ratio (INR), blood pressure (BP), low density lipoprotein (LDL), and hospitalizations for CV disease in the 6 months prior to and after enrollment in the PDPS. In addition, the mean percentage of INR, BP, and LDL at therapeutic goal as determined by national guidelines were compared before and after enrollment.
RESULTS: For the 18 patients on warfarin, INR increased from 2.32 ± 0.71 to 2.56 ± 0.49 ($p<0.031$). There were 54 patients with hyperlipidemia in whom the LDL decreased from 133 ± 41 to 109 ± 6.5 ($p<0.005$). In the 36 patients who had uncontrolled hypertension (HTN), BP decreased from 159 ± 16/86 ± 10 to 148 ± 19/81 ± 10 mm Hg ($p<0.000$ and $p<0.006$, respectively for systolic and diastolic BP). Total CV-related hospitalizations decreased from 35 to 20 in the same period. With regard to mean percentages of clinical values at therapeutic goal, percentage of INR values at goal increased from 42% to 57%, LDL values at goal increased from 22% to 50%, and 36% of patients with HTN at baseline achieved goal BP at 6 months.
CONCLUSIONS: Clinical outcomes improved and the number of hospitalizations for CV events declined when the cost burden of prescription drugs was minimized by participation in the PDPS. Consequently, health care insurance plans that do not provide coverage for prescription drugs may be more costly secondary to poor disease control and increased hospitalizations.

182. Pharmacist impact on phenytoin use in head injury patients. *Gretchen M. Tush, Pharm.D.*, Eljim P. Tesoro, Pharm.D., Gretchen L. Schrote, William R. Garnett, Pharm.D., FCCP; Virginia Commonwealth University, Richmond, VA.

PURPOSE: Phenytoin (PHT) has been shown to prevent early (less than 7 days) post-traumatic seizures. The objective of this study was to evaluate the use of phenytoin in patients with head trauma before (BP) and after (AP) pharmacist intervention.
METHODS: A chart review was conducted in 110 patients with head injuries meeting the criteria for seizure prophylaxis. Information was incomplete for all patients; however, endpoints were identified.
RESULTS: There were 43 patients in the BP group and 67 in the AP group. The average number of patient days on PHT was 13.5 BP and 7.5 AP. The duration of PHT treatment was no more than 7 days in 35% of the patients BP and 69% AP. The average number of PHT levels per patient was 10.4 BP and 3.5 AP, which represented a savings of $17,598. PHT levels were drawn more than 8 hours after the last PHT dose in 21% of the patients BP and 31% AP. Of the PHT levels drawn appropriately, 33% were in the target range (10-20 µg/ml) BP and 58% AP. Only 12.5% of the patients evaluated had a mini loading dose and dosage adjustment for PHT levels less than the target range BP vs 35% AP. Seizures occurred in 7% of the patients BP and 4.5% AP. IV to PO switches occurred in 68% of patients BP and 91% AP, representing a savings of $3640 in drug administration costs.
CONCLUSION: Pharmacist intervention resulted in more appropriate use of PHT and PHT monitoring, and reduced patient costs.

183. Multidisciplinary approach to promote rational use and reduce resistance patterns against antimicrobials in the intensive care unit of a teaching hospital. *Adnan Gauhar, B.S.*, A.L. Sheikh, A.R. Sarwari; The Aga Khan University Hospital, Karachi, Pakistan.

PURPOSE: A multidisciplinary team was brought together with the objectives of reducing antimicrobial resistance patterns and to promote rational use of antibiotics in the intensive care unit (ICU). The ICU at the Aga Khan University Hospital consists of a 14-bed unit catering to the needs of

critically ill medical and surgical patients. Microbiologic specimens data from 1997 from the ICU revealed that 66 to 85% of gram-negative strains exhibited resistance to third generation cephalosporins.
METHODS: The team carried out 1-hour clinical rounds daily and suggested recommendations regarding the choice of antibiotics and infection control measures based on patient-specific data. A rotational antibiotic usage program was implemented. A clinical pharmacist monitored patient profiles for acceptance of recommendations and documented them using a computerized pharmacist intervention program.
RESULTS: Evaluations of these rounds from January to September 1998 indicated that 123 (95%) recommendations were accepted with total cost savings to patients of Rs. 3,25,000 (U.S. $7000). The resistance to third generation cephalosporins ranged from 46-71%. The antibiotics utilization in the ICU showed a decrease in use from 15% to 9%. The institutional cost savings included 1000 hours of nursing time and Rs. 2.4 million (U.S. $52,174) for antibiotic charges.
CONCLUSIONS: The presence of a recognized team of experts in antimicrobial management and the non-confrontational approach of the team were key factors in obtaining physician acceptance of the recommendations. Future strategies include broadening the scope of interventions through formation of similar programs all over the hospital.

Administration

184. Quality assurance program for a drug information center. *Grant Sklar, Pharm.D., BCPS*, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia

A quality assurance program was developed for a drug information center at a tertiary care, teaching hospital. Evaluation criteria were chosen with an outcomes focus and included timeliness of the information, accuracy, objectivity, completeness, and use in patient care. A questionnaire was sent each month to a random sample of 10% of the callers to the center. Returned questionnaires were evaluated on a quarterly basis and results compared to pre-defined standards for each of the evaluation criteria. A response rate of 56% was achieved. Results from the first year of this program showed that, overall, callers to the drug information center were very satisfied with the quality of service provided. No major changes were needed by the staff or the center to improve the quality of service. Based on these positive results, the frequency of sending questionnaires was decreased to three months out of the year, as part of an ongoing quality assurance program.

185. Documenting the value of pharmacist clinical interventions. Ahmed H. Al Jedai, B.S., Ibrahim M. Hamasni, B.S., *Khaled M. Alhaidari, Pharm.D.*; King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia.

PURPOSE: Satellite pharmacists participate in multidisciplinary clinical rounds in medical surgery intensive care units five days per week, and three days per week in nephrology clinical rounds. Pharmaceutical care activities and clinical interventions were either not documented or inconsistently documented on inappropriate forms.
METHODS: In July 1997, we developed a pharmaceutical care drug intervention form, which was built on the pharmaceutical care model and reflected pharmaceutical care activities and interventions of pharmacists on clinical rounds.
RESULTS AND CONCLUSIONS: Satellite pharmacists' clinical interventions for August-September 1997, were reviewed and analyzed. A total of 356 clinical interventions were reported; 18.8% were for pharmacokinetic interventions, 53.9% for pharmacotherapeutic interventions, 13.81% for drug information, and 13.5% for miscellaneous interventions. Ninety-two interventions (25.8%) resulted in cost savings. The magnitude of cost savings will be calculated in phase II of the study. In April 1998, all clinical pharmacists started to use the pharmaceutical care drug intervention form for documenting their clinical interventions. A computer program is being developed for reporting departmental clinical statistics.

186. Application of ICD-10 activity codes into clinical pharmacy in Australia. *Jo-anne E. Brien, Pharm.D.*, Danielle N. McLennan, B.Pharm., Michael J. Dooley, B.Pharm.; Monash University, Parkville; Peter MacCallum Cancer Institute, East Melbourne, Victoria, Australia.

PURPOSE: To implement pharmacy-specific ICD-10 activity codes into clinical pharmacy practice and evaluate their applicability.
METHODS: The World Health Organization's *International Statistical Classification of Disease and Health Related Problems–Tenth Revision (ICD-10)* was modified to include an Australia classification for allied health. The National Centre for Classification in Health, in association with the Society of Hospital Pharmacists of Australia (SHPA) Casemix Working Party and Committee of Specialty Practice in Clinical Pharmacy, developed the pharmacy-specific activity codes that are now included in the ICD-10-AM classification system. A review of the SHPA Standards of Practice for Clinical Pharmacy was undertaken to further define each of the activity code descriptors. Clinical activities were routinely recorded within the ICD-10-AM framework and applicability critically evaluated.
RESULTS: Disparity between the interpretations of the activity codes was discussed and clarified to achieve uniformity and standardization in coding. A structured framework is now available to classify clinical pharmacy activities in a consistent manner. While the codes describe the majority of clinical pharmacist's activities, interventions, and some other activities, require separate classification.
CONCLUSIONS: The Australian modified ICD-10-AM codes provide the opportunity to standardize the documentation of pharmacists contribution to patient care. The codes provide a comprehensive framework for reporting activities. Consistent interpretation is paramount to the wider application of these codes.

187. Documentation of pharmaceutical interventions. *Hannelore Kreckel*, Inge Koch, Rudolf Pantze; Justus-Liebig University, Giessen, Germany.

PURPOSE: Pharmaceutical interventions are an input of clinical pharmacists to the process of patients' care. Documentation of pharmaceutical interventions is necessary to prove the value of patient counseling and information given to patients, physicians, nurses, and other health care workers.
METHODS: A computer-assisted documentation system for pharmaceutical intervention was established, evaluated, and compared with manual documentation. Short background information of each patient's situation is collected in the database. The pharmaceutical interventions are categorized according to their clinical context and stored in the program.
RESULTS: One of the advantages of the computerized documentation system in comparison to the manual system is the quick and easy access to the collected data, and the opportunity to link data in various ways and to evaluate the stored information in different ways. The stored data are structured and can be quantified. Interventions occurring repetitively can be used to identify structures and practices so that the therapeutic process can be changed. Before starting a computer-based documentation, it is necessary to quantify the data collection and to clarify the problem of storing personal data within the hospital setting. Misuse of data must be avoided.
CONCLUSION: The program can be used as a continuous quality improvement tool. Documentation of pharmaceutical interventions is helpful to assess the clinical pharmacists' work and workload and to demonstrate the quality and impact of their work considering the whole therapeutic process as well as costs and legal aspects.

188. Use of a decision-making model to assess the quality benefits of a pharmacist's interventions. *Pernille J. Sorensen, Pharm.D.*, Peter Mielche, Pharm.D.; Viborg Hospital, Denmark.

The pharmacist's role in the decision making of drug therapy is an essential element of clinical pharmacy. Optimal decisions are needed to maximize patient response and prevent or resolve drug-related problems. The core of achievement is the degree of influence that pharmacists have on drug therapy decisions. Evaluation of clinical pharmacy services and its effect on patient outcome is becoming increasingly important in Denmark. As the first ward pharmacist employed full-time in Denmark, the value of the Danish pharmacist as part of the clinical team must be demonstrated based on patient outcomes and the economic effect of the pharmacist's interventions.
The aim of this study is to analyze the role in decision making of a pharmacist and the quality benefits of interventions to patients, nurses, and physicians in determining performance indicators for a ward pharmacist. In the study, a decision-making model is used to analyze the operative level of the pharmacist during intervention monitoring. When linked to both patient outcome and nurse and physician acceptance, this provides a qualitative approach to measuring clinical performance.
Interventions have been recorded and downloaded onto an Access database. To facilitate outcome measurements, recording the details of interventions has been standardized to include a description of the problem, advice given, action taken, outcome, and economic effect.
To evaluate the performance indicators determined, a program was constructed to draw and analyze data from the Access database.
This study shows that the value of a ward pharmacist is quite important in Denmark, and illustrates that the pharmacist can achieve great authority and acceptance from physicians. It shows that pharmacists' interventions can save money and improve the outcome of patients.

189. Practice-based research: key foundation for pharmacy administration to stimulate clinical development. *Carole R. Chambers, B.S., MBA*; Alberta Cancer Board, Calgary, AB, Canada.

PURPOSE: Practice-based research projects can offer the ability to pilot new clinical services, enhance department knowledge in diverse areas such as pharmacoeconomics and outcomes research tools, and justify enhanced services to patients.
METHODS: Summer pharmacy student projects were developed since 1996 to provide a focus in moving clinical pharmacy forward. Each student was assigned a pharmacist mentor so diffusion of knowledge gained within the staff was a part of the process. Alternative funding was obtained for all projects so that the department budget was untouched.

RESULTS: Thirteen projects involving 17 students have been completed and will be highlighted in this presentation. Attracting $85,000 in resources, all projects were also submitted for peer-reviewed publication. Three publications have resulted with another eight under active consideration. Themes for the summer projects have centered around outcomes (economic, clinical, and humanistic), and pharmacy services of value, as defined by patients. New clinical pharmacy initiatives evolving out of this research have included an automated voice mail refill system, outcomes monitoring programs in the drug utilization program, drug program support positions for patient teaching, a parenteral manual, a patient newsletter from pharmacy, and a patient call back program.
CONCLUSIONS: Summer student projects are an excellent medium in which to further develop clinical programs within constrained resources. The enthusiasm of students, the closure of specific projects, and the mentorship by pharmacists all contribute to the success of this venture.

190. Clinical pharmacy workload statistics: fast, simple, and linked to outcomes. *Suzanne C. Malfair Taylor, Pharm.D., BCPS*, Lynne Nakashima, Pharm.D., Mary-Anne Hiatt, Carol Mah, Linda Wong; British Columbia Cancer Agency, Vancouver, BC, Canada.

PURPOSE: The goal was to develop and evaluate a fast and simple method of documenting clinical pharmacy services which would reduce time spent recording workload statistics and facilitate a link to patient outcomes data.
METHODS: A pharmaceutical care coding system (PC codes) was developed to represent the eight types of drug-related problems. From October 1998, pharmacists incorporated these codes into notes written in the medical record. Health information personnel added three fields to their current abstracting process: PC code, pharmacist identification, and date. Already included in the abstracting process were: patient demographics and details about admission, discharge, diagnosis, procedures, and complications. Monthly reports were designed to list clinical pharmacy workload and link this with the collected outcomes data.
RESULTS: Prior to this project, interventions were recorded in the chart in a non-standardized manner and workload statistics were recorded separately (15-30 minutes/day off the ward for this). This project eliminates redundant documentation and allows pharmacy contributions to be viewed and used by the interdisciplinary team, and serve as workload statistics at the same time. The first report will be analyzed and ready for presentation in early 1999.
CONCLUSIONS: This documentation method permits more time on the ward and less time recording redundant workload information, while facilitating a link to outcomes data. The plan is to use the perpetual results to perform quality assurance and justify clinical pharmacy services. In the future, attempts will be made to collect more specific outcomes data such as quality of life, patient satisfaction, and/or cost.

191. Justification of clinical pharmacy services in inpatient and ambulatory care settings through use of a scannable form. *Dereck W. Wentworth, Pharm.D., BCPS*, Dayna C. Mitchell, Pharm.D., BCPS, Kavita R. Palla, Pharm.D., BCPS, Eui-Sook Kim, B.S., Maureen H. Jung, Pharm.D., Raymond J. Byrne, Pharm.D., BCPS, Barbara E. Poddig, Pharm.D., BCPP, Donald L. Kendzierski, Pharm.D., Dave E. Zacher, B.S., M.H.A.; Edward Hines, Jr. VA Hospital, Hines, IL.

PURPOSE: Due to the downsizing of programs, it is vital clinical pharmacists (CP) document their provision of pharmaceutical care. Historically it has been difficult for CPs to adequately record their activity because of perceived time constraints. To address this need, pharmacy service developed a scannable pharmaceutical care encounter (PCE) form.
METHODS: The PCE forms were created using commercial software and were scanned using a high-speed scanner. Five categories of data were collected: rationale for intervention, recommendations/actions, patient outcome, time involved with the patient, and impact of intervention.
RESULTS: From December 1997 through June 1998, eight CPs collected 8784 interventions (average 1030 interventions per month). The most frequent problem CPs identified was "lab warrants intervention" (46%), primarily from a pharmacist-run anticoagulation clinic. Other common interventions were "test not ordered" (29%), "wrong dose" (15%), and "drug therapy needed or not prescribed" (15%). CPs educated providers 1879 times and patients 812 times during this period. The CPs influenced providers to make 1851 dosage changes, 1499 drug additions, and 961 drug discontinuations. CPs impacted patient morbidity 2917 times and patient mortality six times. Fifty-one percent of interventions were documented in the medical record. Presentation of data to administration was partly responsible for justification of current positions and the approval of an additional ambulatory care CP. A future pilot will attempt to estimate cost savings and avoidance.
CONCLUSION: The PCE form allowed data collection with minimal time investment. Further work identifying cost savings and avoidance, and improving documentation in the medical records, will give additional credibility to the delivery of pharmaceutical care.

192. Justification and mechanisms of revenue generation in a pharmacist-managed antithrombosis clinic. *Edith Nutescu, Pharm.D.*, Jinhee Jahng, Pharm.D. candidate, Richard K. Lewis, Pharm.D., MBA; University of Illinois at Chicago, Chicago, IL.

PURPOSE: Pharmacist-managed clinical services face many obstacles in the area of reimbursement. The purpose of this project is to identify successful mechanisms of revenue generation in a pharmacist-managed antithrombosis clinic (ATC).
METHODS: The ATC averages 200 patient visits per month using a main mechanism to generate revenue by billing under a physician's provider number. Cost savings documented by tracking clinic outcomes and time spent on student and resident education comprise our indirect methods of reimbursement and service justification. A convenient location of our clinic within the pharmaceutical care center (PCC) allows yet another mechanism for generating revenue, the "one stop shopping" concept. The ATC pharmacotherapist seeing patients for anticoagulation follow up can also dispense patients' prescriptions, assisted by a clinical technician. The medical records and prescription records of 137 patients have been reviewed and revenue generated was calculated before and after ATC implementation.
RESULTS: Before ATC implementation, 21 (15%) currently enrolled patients received their medications from the PCC, accounting for total revenue of $64,605.18 per year. Two years after ATC implementation, 65 (47%) patients receive their medications during their ATC visits. Total revenue generated from patients receiving prescriptions during ATC visits amounts to $258,425.74 per year.
CONCLUSION: In addition to our standard revenue generating mechanisms, the "one stop shopping" concept allows an additional reimbursement tool that aids in the cost justification of a pharmacist-managed ATC.

193. The utilization of prescription revenue to assist in the cost justification of pharmacist-managed clinics. *Richard K. Lewis, Pharm.D., MBA*, Edith Nutescu, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

PURPOSE: The purpose of this study is to determine the value of including prescription revenue in the cost justification of pharmacist-managed clinics.
METHODS: Prescription records for 300 patients enrolled in three pharmacist-managed clinics (anticoagulation, lipid management, and refill-10 clinics) were reviewed before and after implementation of the clinics. Prescription volume and the revenue generated were documented. In addition, the patients were surveyed to determine where they had their prescriptions filled and to obtain a self-assessment of their level of compliance. The revenue generated was compared with the costs of running the clinics and the costs of dispensing the prescriptions.
RESULTS: Preliminary results indicate that more than 50% of patients were purchasing their prescriptions at outside pharmacies and had an average compliance rate less than 80% prior to clinic enrollment. Revenue generated through increased prescription capture and improved compliance covered the expenses associated with dispensing their prescriptions and offset the cost of more than one FTE of pharmacist time in the pharmacist-managed clinics. If all prescription revenue is considered, nearly two FTEs of pharmacist time can be offset in the pharmacist-managed clinics.
CONCLUSION: The utilization of prescription revenue generated through prescription capture and improved compliance is a practical consideration in the cost justification of clinical pharmacy services.

194. Documentation of pharmacists' clinical interventions using Clinitrend™ on portable Toshiba Libretto mini-notebook computers: a pilot study. *Patricia A. Flores, Pharm.D., BCPS*, Michael A. Militello, Pharm.D., Donna L. Capozzi, Pharm.D., Kristin K. Gilliland, Pharm.D., Todd W. Nesbit, Pharm.D., BCPS, Morton P. Goldman, Pharm.D., BCPS, David A. Kvancz, M.S.; The Cleveland Clinic Foundation, Cleveland, OH.

Documenting the value of pharmacists' clinical activities is essential as pharmacists become increasingly involved in patient care activities. We conducted a pilot study to evaluate a portable computerized system for documenting pharmacists' clinical interventions at our institution.
PURPOSE: To assess the documentation system in terms of ease of use, effectiveness, efficiency, and level of user satisfaction compared to the present paper documentation system, and to determine the potential for institution-wide expansion.
METHODS: Three pharmacy clinical specialists and one resident participated in the 4-week pilot. The participants documented all interventions and activities on Clinitrend' software using pocket-size Toshiba Libretto mini-notebook computers. They also completed a questionnaire prior to and after implementation of the pilot.
RESULTS: A total of 487 interventions requiring approximately 30 hours per person were documented during the study period. The majority (86%) were classified as having moderate to major significance. The outcomes of most interventions included increased safety (25%), enhanced therapy (23%), or a combination of cost savings plus increased safety or enhanced therapy (24%). Survey results reflected an increase in the percentage of interventions documented from 62% to 78% before and after implementation of the pilot, respectively. Ease, effectiveness, and completeness of documentation were also ranked higher with the computerized system, while efficiency was rated as comparable to the present documentation system. Estimated cost savings

for the study period were $23,532. Overall user satisfaction with the computerized documentation system was 3.5 out of 5 possible points. Three of the four study participants recommended the Clinitrend/Toshiba Libretto system for hospital-wide expansion.
CONCLUSIONS: Our findings support the potential usefulness of a portable computerized system for documenting pharmacists' clinical interventions.

195. Use of a database of clinical pharmacy interventions for clinical pharmacy management. *Michael G. Tierney, M.S.*, Kenneth A. Potvin, B.Sc.Phm., CHE, Myrella T. Roy, Pharm.D., FCCP; Ottawa Hospital, Ottawa, ON, Canada

PURPOSE: To describe how an electronic, patient-specific program for documenting clinical pharmacy activities assists in managing clinical pharmacy services.
METHODS: Since 1996, clinical pharmacists in a 400-bed acute care hospital have been documenting each clinical activity they perform in the hospital pharmacy patient care system on a patient-specific basis. Each of 24 individual clinical activities is associated with a workload unit. These data are then transmitted to the hospital's case-costing computer system where they are combined with demographic and clinical information. The resulting database of information allows us to profile specific or collective clinical pharmacy activities by pharmacist, medical service, diagnosis, or attending physician.
RESULTS: Between April 1996 and August 1998, 175,300 clinical activities have been documented, including 74,000 interventions to change a patient's therapy. On a quarterly basis, summary reports are generated for clinical managers and individual pharmacists. These include a graphical presentation of the types of activities and workload units associated with each pharmacist. This information provides pharmacists and clinical managers with a profile of how pharmacists spend their patient care time and can be used to compare profiles of pharmacists. Pharmacists can compare themselves to their peers. In addition, the information can be used to summarize services provided to specific patient populations which has been useful in documenting the value of clinical pharmacy. We are currently investigating whether this database can be used to assist in allocation of clinical pharmacy resources among inpatients.
CONCLUSIONS: Computerized, patient-specific clinical documentation can provide valuable information to clinical pharmacy managers.

196. Design and effectiveness of an innovative pharmaceutical care practice system using an electronic health record for documenting clinical interventions, tracking service statistics, and electronically reporting adverse drug reactions and data to JCAHO. *Marilyn G. Bufton, Pharm.D.*, Tony Abe, MBA; St. Joseph Hospital, Bellingham, WA.

In 1996, the pharmacy designed and implemented an innovative pharmaceutical care (PC) practice and documentation system that is integrated seamlessly within an electronic health record (EHR). Clinical pharmacists use 50-60 interventions created in the orders module of the EHR to capture PC for inpatients. The results of care are electronically charted on a real time basis to complement electronic medication charting. Pending and completed care events are viewable by pharmacists, physicians, clinicians, and management to facilitate an efficient workflow, interdisciplinary communication, and continuity of care. Special links and formats were created to generate data for improved adverse drug reaction and JCAHO reporting. PC practice statistics are seamlessly captured from the care system by weekly importation of EHR data into a MS Access™ database and selectively reported to ORYX™. The practice focus of the pharmacist is maintained instead of capture of statistics as occurs in niche software. The raw data and statistics are queried using MS Access™ for service tracking, evaluation, and justification; performance evaluation; and process/practice improvement. Our EHR model using IDX/Lastword™ enhances the practice of PC by providing an electronic format for documentation of care and problem solving by the pharmacist which is fully integrated with other clinical care and data. The EHR also effectively provides for electronic capture of service statistics and data for JCAHO reporting while enhancing continuity of care and interdisciplinary communication.

Adverse Drug Reactions/Drug Interactions

197. Adverse drug reaction reporting in a teaching hospital in Oman. *Yolande I. Hanssens*, Amna K. Al-Hashar, M.S., Ibrahim S. Al-Zakwani, M.S., Aqeela M. Taqi, B.S., Elizabeth A. Worthing, M.S., Margaret N. Kyegombe, M.S., Kassim A. Al-Riyamy, B.Pharm., M.Phil.; Sultan Qaboos University Hospital, Muscat, Oman.

PURPOSE: To evaluate the impact of 1) clinical pharmacists' active involvement, and 2) reminding and updating hospital staff on adverse drug reaction (ADR) reporting in Sultan Qaboos University Hospital (SQUH), Sultanate of Oman.
METHODS: The ADR reports were reviewed over a period of eight years. Since 1996, summaries of the received ADR reports have been provided on an annual basis, complete with reminders and alerts on the importance of ADR reporting through the pharmacy bulletin.
RESULTS: SQUH is a 325-bed teaching hospital which opened in 1989 and employs international nursing and medical staff. The ADR reporting form, similar to the British yellow form, was implemented in 1990. The number of reports received in relation with the different actions taken is provided. No reports were received during the first three years.

Year	Action*	Number of ADR Reports
1990	Implementation of ADR form	0
1993	Reminder from Pharmacy and Therapeutics Committee	3
1994	Involvement of clinical pharmacists	32
1995	ADR alerts in pharmacy bulletin	34
1996	1995 overview in pharmacy bulletin	72
1997	1996 overview in pharmacy bulletin	59
1998	1997 overview in pharmacy bulletin	105**

*actions also included active involvement of clinical pharmacists (i.e., alerting doctors and nursing staff, initiating and following up the reports, providing extra ADR information whenever requested) and putting alert posters on the wards; **through September, 1998

CONCLUSIONS: The active involvement of clinical pharmacists in ADR reporting, as well as feedback, alerts, and reminders through a channel such as a pharmacy bulletin, resulted in better ADR awareness, as well as a significant increase in the number of ADRs reported.

198. The impact of pharmacist-initiated discharge prescription writing on adverse drug reactions and medical center drug costs. *Rebecca A. Feil, Pharm.D.*, William N. Jones, M.S.; Veterans Affairs Medical Center, Tucson, AZ.

PURPOSE: Budgetary constraints are causing our pharmacy service to explore new cost containment measures. The Veterans Affairs Medical System is closed, so patients receive care and medications from this source. Patients are usually given a complete set of new medications with each hospital discharge. This results in medication stock piling and unnecessary expenditures. Several cases of excessive dosing were documented because patients took old and new medication supplies together. Johnson and Bootman estimated a $76.6 billion expenditure per year for adverse medication reactions in ambulatory care, thus additional medication misadventures are suspected. This project allows pharmacists to write the discharge prescriptions for items that patients do not have and to cancel old prescriptions in an attempt to decrease adverse medication reactions and limit costs.
METHODS: Two comparison groups were created. Pharmacists write discharge prescriptions for one ward (group 1) and physicians and nurse practitioners write orders for an identical ward (group 2). Return visits for adverse reactions and costs of discharge medications were compared. Costs saved by not dispensing duplicate medications were also analyzed.
RESULTS: Initial evaluation reveals a trend toward decreased adverse drug events in group 1 compared to group 2. Preliminary analysis indicates group 1 had an average cost for discharge prescriptions of $92.45 compared to group 2, with an average cost of $204.76. Pharmacists saved an average of $14,976 per quarter in duplicate medications not dispensed.
CONCLUSIONS: Pharmacists should continue to write discharge prescriptions in this setting.

199. Impact of medication-related problems on emergency department visits. *Madeline Camejo, Pharm.D.*, Joseph P. Spillane, Pharm.D., Joseph F. Scott, M.H.A., Kathy K. Graham, Pharm.D., Lisa R. Colodny, Pharm.D., BCNSP; Broward General Medical Center, Fort Lauderdale, FL; Nova-Southeastern College of Pharmacy.

PURPOSE: Evaluate emergency department (ED) visits due to preventable medication-related problems (MRP), identify patient populations to benefit from medication education, identify causes of MRP, and assess the financial impact to the health care system.
METHODS: Patients with acute infections or manifestations of disease states, absence of medications, and trauma were excluded. Data collected included patient demographics, reason for ED visit, reason for noncompliance, and medication history.
RESULTS: Of 720 patients interviewed, 54% met inclusion criteria and 23% presented with MRP. Median age was 52 years, 47% were male, 2% were college graduates, 38% were high school graduates, and 60% had less than a high school education. Cardiac, asthmatic, diabetic, psychiatric, and pain disorders were the major disease states encountered. Medication refill requirement, lack of ability to visit a pharmacy or physician during regular hours, and lack of compliance information was reported by 34%, 9%, and 23% of patients, respectively. Eighteen percent self terminated their medication, 7% reported ED as the primary source of health care, and 4% reported lack of ability to pay for medication. Primary health care patients, Medicare/Medicaid, HMO/PPO, and private pay accounted for 53%, 19%, 20%, and 8%, respectively, of those interviewed with a MRP. Nineteen percent required hospitalization, which accounted for $111,936. Costs

associated with remaining patients amounted to $18,020. In total, $129,956/month was attributed to MRP. This figure extrapolated annually represents over $11 million, $8 million of which are tax-assisted funds.
CONCLUSION: Elimination of system barriers including medication refill clinics and disease state management clinics may be significantly cost effective by reducing the number of nonemergent ED visits.

200E. Medication-related problems: a common cause of hospital readmission. *Bob L. Lobo, Pharm.D.*, David W. Reinke, Pharm.D., Lance L. Swearingen, M.S.; Methodist Healthcare, Memphis, TN; Baylor University, Dallas, TX.

Presented at the 24th Annual Midwest Pharmacy Residents Conference, Kansas City, MO, April 16, 1998.

Cardiology

201. Care for the elderly in European towns: prevalence and treatment of hypertension in a sample of elderly persons. *Eleonora Marrazzo, Pharm.D.*, Lorenza Ferraro, Pharm.D., Emanuela Fiorio, Pharm.D., Marilena Romero, Pharm.D., Gianni Tognoni, M.D.; Drug Information Centre A.S.L. 1, Torino, Italy; Servizio Farmaceutico Territoriale A.S.L. 4, Torino, Italy; Istituto Mario Negri Sud, S. Maria Imbaro, Italy; Istituto Mario Negri, Milano, Italy.

Hypertension and its complications constitute one of the most frequent causes of morbidity and mortality in many industrialized countries, and are an important health problem for the elderly population.
The aim of this research was to describe the prevalence of hypertension, the pharmacologic treatment, and the morbidity in a sample of 6318 elderly persons (aged greater than 70 years) recruited by 247 general practitioners in 18 European cities in five countries (Italy, France, Spain, Sweden, and Serbia) during June and July 1996. The drugs were codified using the ATC classification; diseases were codified by ICD-9.
Patients with a diagnosis of hypertension comprised 2612, of whom 1635 (63%) were women and 977 (37%) were men. The therapeutic groups most frequently prescribed were agents acting on the renin-angiotensin system, alone or in association with calcium-channel blockers.
The most frequent diagnoses associated with hypertension in men were diabetes (13%), hyperplasia of the prostate (13%), osteoarthrosis (5%), and chronic bronchitis. For women, osteoarthrosis and diabetes (12%) were the most frequent co-diagnoses.
This research is an example of how a close collaboration between pharmacists of the National Health Service and general practitioners can provide pharmacoepidemiologic data of great utility to describe the quality of assistance provided for some types of patients, and may serve to start up a program of training and information for general practice.

202. A pertinent management for patients with suspected venous thromboembolic disease: a quality assurance program at a university hospital. *V. Le Jeune*, E. Le Moigne, G. Piriou, C. Balcon, E. Vernotte, C. Pitre, M.P. Pomey, D. Mottier, N. Borgnis-Desbordes; University Hospital, Brest Cedex, France.

PURPOSE: Venous thromboembolism (VTE) is a frequent (700,000 cases per year) and serious disease (20,000 deaths per year) in France. The aim of this assessment, carried out at the University Hospital of Brest, is to highlight the local malfunctions in the diagnostic and therapeutic approach of this disease, taking into account the strategies of consensus.
METHODS: Patients with a suspected VTE were identified by gathering data from emergency unit records, prescriptions of specific explorations, or courses of anticoagulant treatment. Five criteria of important malfunctions were selected: a diagnostic waiting period of more than 48 hours, absence of anticoagulant treatment when VTE is suspected, a diagnosis based on D-Dimer test only, and no further tests after an inconclusive echo-Doppler or pulmonary scintigraphy.
RESULTS: From January to July 1997, 417 patients were included; a positive diagnostic was performed for 35% of them. The diagnostic waiting period was more than 48 hours in 145 out of 417 patients (34.6%). One hundred fifty-three patients (36.4%) did not receive anticoagulant treatment when VTE was suspected. D-Dimers test was the only test performed for three patients. Fourteen inconclusive echo-Doppler (of 342 tests) and 40 nonexclusive pulmonary scintigraphies (of 252 tests) did not lead to any subsequent explorations.
CONCLUSIONS: This study shows important local malfunctions. A work group has been set up to define corrective measures as protocols to help medical staff in best managing such patients. The impact of these procedures will be checked by performing another assessment using the same method.

203. Implementation of a pharmacist-led lipid management program for patients undergoing elective coronary revascularization. *Helen J. Williams. B.Pharm., M.R.Pharms.S.*, King's College Hospital, London, United Kingdom.

PURPOSE: Hyperlipidemia is a risk factor for coronary heart disease. National guidelines advocate lipid lowering in patients undergoing coronary artery bypass graft (CABG) surgery with total cholesterol greater than 5.5 mmol/L, while local policy is to treat patients with levels greater than 5.0 mmol/L. Initial audit of elective CABG surgery patients (n=26) demonstrated that lipid status was poorly documented on admission. Appropriate lipid management could be established in only 7% of patients. This program was initiated to address the need for lipid intervention in these patients.
METHODS: Elective CABG patients are seen by the pharmacist during pre-admission assessment clinic; a full review of current lipid status is undertaken. Fasting lipid levels are obtained through liaison with general practitioners or referring cardiologists. Where appropriate, lipid-lowering strategies are initiated, patient counseling undertaken, and recommendations passed on to clinicians in primary care. The impact of this program was assessed through re-audit.
RESULTS: Re-audit (n=150) demonstrated a significant improvement in the level of lipid intervention. Lipid status was recorded in over 90% of elective patients. Lipids were assessed as being appropriately managed in 32% of patients prior to admission, with intervention on objective grounds being made in a further 58%. Interventions made include dietary advice, medication initiation, change of agent or dosage, re-testing, or referral to specialists.
CONCLUSIONS: The role of the pharmacist has been extended through implementing an evidence-based approach to lipid management in cardiothoracic patients. The pharmacist is now responsible for overseeing lipid management and has become an established member of the clinical team.

204. Patient outcomes in an outpatient pharmacy-conducted anticoagulation clinic, 1995–1998. Lauren C. Duty, Pharm.D., T. Lynn Stevenson, Pharm.D., *P. David Brackett, Pharm.D.*, Thomas H. Cobb, Pharm.D., Joseph P. Liss, Pharm.D.; Columbus Regional Healthcare System; Auburn University, Auburn, AL.

PURPOSE: The purpose of this analysis was to document patient outcomes in a pharmacist-managed comprehensive anticoagulation clinic in order to assess the clinical benefit provided by our service.
METHODS: We compiled retrospective data including patient demographics, indications for anticoagulation, compliance with medications and clinic visits, and incidence of minor bleeding, major bleeding, strokes, and recurrent thromboembolism for the 84 patients who had at least two visits to our clinic between January 1995 and June 1998. For patients who had complications, we assessed the level of anticoagulation
RESULTS: Of the patients reviewed, 52% were compliant with their medication and 70% were compliant with their clinic visits. The incidence of minor bleeding was 20.2% while 7.1% experienced minor bleeding with an excessive international normalized ratio (INR). Two patients (2.4%) experienced major bleeding, with one of these patients having an excessive INR. No patients experienced stroke and one patient (1.2%) had recurrent thromboembolism. In all cases, the incidences of complications in our clinic were at least comparable to and often favorable to published national data.
CONCLUSION: Based on the favorable comparison of our clinic's outcomes to national data, we conclude that patient care was enhanced and an important and valuable service is being provided to our patients.

205. Narrowing the cholesterol treatment gap: results of the pravastatin to simvastatin conversion-lipid optimization program. *Matthew K. Ito, Pharm.D., BCPS*, Stephen N. Stolley, Pharm.D., BCPS, Anthony P. Morreale, Pharm.D., BCPS, Jennifer C. Lin, Pharm.D., David B. Marcus, B.S.; University of the Pacific, Stockton, CA; Veterans Affairs San Diego Heath Care System, San Diego, CA.

It is recognized that a majority of hypercholesterolemic individuals fall short of meeting the LDL cholesterol goals recommended by the NCEP. We describe the results of a structured formulary conversion-lipid optimization program designed to narrow this treatment gap. A total of 1115 patients receiving pravastatin were eligible for conversion to simvastatin by means of the pravastatin to simvastatin conversion-lipid optimization program. Patients were converted to simvastatin by pharmacy (n=783) or their primary care provider (n=332). The conversion dose of simvastatin was based on the additional percentage reduction in LDL cholesterol needed. The mean age of our cohort was 64 ± 10 years; 98% were males. Sixty-six, 28, and 6% of patients had a history of coronary heart disease (CHD), more than two CHD risk factors (RF), and less than two CHD RF, respectively. The mean daily dose of pravastatin and the conversion dose of simvastatin were 25 ± 11 and 23 ± 13 mg, respectively. The median baseline and follow-up LDL cholesterol were 116 and 98 mg/dl, respectively ($p<0.001$). The percentage of patients meeting goal when stratified by CHD risk at baseline were CHD = 34%, more than two CHD RF = 57%, and less than two CHD RF = 70%. Following optimization, these percentages increased significantly to 61% ($p<0.001$), 76% ($p<0.001$), and 87% ($p=0.03$), respectively. The predicted mean (95% CI) RR of a future CHD event based on changes in serum lipids is 0.84 (0.82 to 0.86) 4 years following optimization. The total cost of the program was just over $42,000 for the first year, with a net savings thereafter. These results suggest that this program is a cost-effective approach to closing the cholesterol treatment gap.

206. The role of group education in the hypertensive patient. *Craig Logemann, Pharm.D.*; University of Iowa, Iowa City, IA.

PURPOSE: This study was designed to assess the effectiveness of multidisciplinary patient education in improving blood pressure control in the hypertensive population.
METHODS: Twenty hypertensive patients from the family medicine clinic received usual medical care plus a quarterly clinic visit with a pharmacist. The pharmacist made therapy recommendations in any poorly controlled hypertensive patient. Patients were randomized to attend or not to attend 6 hours of hypertension education taught by various health professionals, including a physician, nurse, pharmacist, dietitian, and exercise specialist. Systolic blood pressures (SBP) and diastolic blood pressures (DBP) were obtained at enrollment and at each quarterly pharmacist visit.
RESULTS: During 9 months of follow up, SBP and DBP (± SD) decreased in both groups. Between-group differences were not found; follow-up visits are scheduled for three patients.

	Education Group n=10	No Education Group n=7	p value
Baseline SBP	154.6 ± 34.5	164.0 ± 12.9	0.50
Baseline DBP	86.4 ± 11.9	86.6 ± 11.6	0.98
Follow-up SBP	141.4 ± 28.0[a]	140.3 ± 16.8[a]	0.93
Follow-up DBP	79.2 ± 13.3[b]	78.3 ± 13.4[a]	0.89

[a]p<0.05; [b]p=0.06 when compared with respective baseline value (paired t-test)

CONCLUSION: While the involvement of a clinical pharmacist in providing monitoring and therapy recommendations in hypertensive patients appears to improve blood pressure control, group education on hypertension-related topics apparently does not.

207. Implementation and evaluation of a congestive heart failure continuity of care program between a community pharmacy and a hospital. *Katherine J. Macek, Pharm.D.*, James A. Miller, B.S., Brenda J. Theis, B.S., Robert G. Ripley, B.S., Jay D. Currie, Pharm.D.; Ruegnitz Pharmacy, Dubuque, IA; Mercy Health Center, Dubuque, IA; University of Iowa, Iowa City, IA.

PURPOSE: Continuity of care (COC) is based on the belief that exchange of information between health care professionals is fundamental in the provision of optimal health care. The current organization of pharmacy practice results in isolated care settings in either the community or the hospital setting. Evidence suggests this lack of continuity increases a patient's risk for developing drug misadventures or adverse effects that result in re-hospitalization, overuse of health care resources, and reduced patient quality of life. This project will attempt to improve the quality of care of patients moving between home and hospital.
METHODS: The project design involves the participation of patients admitted to Mercy Medical Center with a primary diagnosis of congestive heart failure (CHF). Upon each patient's admission to the CHF COC program, the hospital pharmacist will identify drug therapy problems (DTP) and document interventions. On patient discharge, a community pharmacist will acquire hospitalization-specific information, assess the patient for DTP, and document interventions during weekly follow ups for one month and bi-weekly follow ups for an additional month.
RESULTS: Two month re-hospitalization rates, DTP rates and intervention descriptions, patient quality of life, and patient attitude regarding pharmacist involvement in care will be measured in the intervention and a control group. Preliminary data will be available for reporting in April 1999.
CONCLUSIONS: This project will demonstrate the impact of a pharmacist-driven continuity of care project in CHF patients to decrease re-hospitalization rates, improve quality of life, and change patient attitude regarding pharmacist involvement in care.

208. The value of pharmacist monitoring for patients receiving standard and low molecular weight heparin. *Patricia A. Howard, Pharm.D., FCCP, BCPS*, Katie Burenheide, Pharm.D.; University of Kansas Medical Center, Kansas City, KS.

PURPOSE: To document the need and potential benefits of pharmacist monitoring for patients receiving antithrombotic prophylaxis or treatment with standard heparin (SH) or low molecular weight heparin (LMWH).
METHODS: A 3-month nonrandomized, concurrent study of patients prescribed SH or LMWH was undertaken. Medical charts were reviewed for drug utilization, laboratory monitoring, in-hospital outcomes, and 3-month readmissions. Data were entered into a database for statistical analysis.
RESULTS: Data from 131 patients were analyzed, including 62 males and 69 females with an average age of 55 years. The mean number of thromboembolic risk factors was 2.7 per patient. Forty-seven patients received SH, 43 enoxaparin, and 41 dalteparin. There were significant differences in the usage of the three agents for surgical, nonsurgical, and long-term rehabilitation indications. Major problem areas identified included: inappropriate dosing based on indication and patient risk, inadequate therapy duration, inappropriate initiation of prophylaxis prior to surgery, and inappropriate laboratory monitoring. Unnecessary aPTT tests were routinely monitored in 51 of the 84 patients on LMWH. During hospitalization, there was one major bleed, one minor bleed, four thromboembolic complications, and two cases of thrombocytopenia. Four of these events were potentially preventable by pharmacist intervention. Three-month readmissions for hemorrhagic or thromboembolic complications are being monitored. An economic analysis of the potential impact of pharmacist monitoring is underway.
CONCLUSIONS: This study documented the potential value of pharmacist monitoring in patients receiving SH or LMWH for thromboembolic prophylaxis or treatment. Based on these findings, a pharmacist protocol is being developed for ongoing monitoring.

209. The potential clinical value of an inpatient clinical pharmacist warfarin counseling and monitoring service. Danielle Graci, Pharm.D., Manjunath P. Pai, Pharm.D., Kevin W. Garey, Pharm.D., Scott A. McConnell, Pharm.D., Joseph S. Bertino, Jr., Pharm.D., *Daniel S. Streetman, Pharm.D.*; Bassett Healthcare, Cooperstown, NY.

PURPOSE: To assess the potential value of an inpatient warfarin counseling and monitoring service.
METHODS: Inpatients initiated on warfarin between February and September of 1998 were identified. Data collected included demographics, laboratory values, indication for warfarin, and concurrent medications. Potential interactions were identified and documented in patients' charts. Patients received warfarin counseling from a clinical pharmacy resident or student and were given a questionnaire to evaluate their satisfaction with the service.
RESULTS: Fifty-three females and 30 males (46-86 years of age) were monitored and counseled during the study period. Indications for warfarin use included knee replacement (37.3%), hip replacement (37.3%), deep venous thromboembolism (8.4%), atrial fibrillation (7.2%), pulmonary embolism (4.8%), valve replacement (2.4%), amputation (1.2%), and cardiomyopathy (1.2%). Patients were receiving a mean of 5.2 ± 2.9 concurrent medications. Sixty percent of patients were taking at least one interacting medication, and 25% of patients were taking at least two interacting medications. Forty-eight percent of patients were below their target international normalized ratio (INR) at discharge. Thirty patients returned completed questionnaires, and 96% of respondents were satisfied with the clinical pharmacy service. Seventy-three percent wanted more information regarding the medications prescribed to them in the hospital, and 90% wanted a pharmacist to provide them with medication counseling if ever in the hospital again.
CONCLUSION: This evaluation identified several potential clinical benefits of an inpatient warfarin counseling and monitoring service. They were demonstrated through documentation of drug interactions, INRs, provision of warfarin education, and patient satisfaction.

210. Implementation of an inpatient warfarin monitoring form. *Michele Y. Splinter, Pharm.D.*; University of Oklahoma, Oklahoma City, OK.

A warfarin monitoring form was developed to increase the percentage of time the international normalized ratio (INR) is within goal range and to decrease the number of INRs performed for inpatients at a rehabilitation hospital. The monitoring form not only documents history of dosing and INRs, but also gives nomograms for initial and maintenance therapy adjustments and a listing of major drug interactions. INR values within various ranges (less than 2.0, 2.0 to 3.0, 3.1 to 3.5, 3.6 to 4.5, greater than 4.5) were compared for all inpatients on warfarin one month prior to and one month following implementation of the monitoring form. INRs performed decreased from 62% to 48.7% of days of inpatient warfarin therapy. INR values less than 2.0 decreased from 40.2% to 29.3%; INR values 2.0 to 3.0 increased from 37.5% to 42.7%; INR values 3.1 to 3.5 increased from 6.5% to 21.3%; INR values 3.6 to 4.5 decreased from 8.9% to 4%; and INR values greater than 4.5 decreased from 6.5% to 2.6%. The percentage of days patients' INRs were subtherapeutic (less than 2) or supratherapeutic (greater than 3.5) decreased as well as the percentage of days that INRs were performed. This resulted in a saving of $330 in laboratory costs in the month following implementation of this monitoring tool.

211E. Evaluation of a pharmacist-managed anticoagulation clinic within an accredited ambulatory care pharmacy: pilot study. *Janet E. Martin, Pharm.D.*, Elizabeth Begg, B.S.; London Health Sciences Centre, London, ON, Canada.

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212. An audit of the cardiovascular risk reduction clinic. *Jessie A. Spencer, Pharm.D.*, Lori D. Finlay, M.S., Philip Kithas, M.D., Ph.D., Ellen Nishi, R.D., C.D.; University of Utah; Salt Lake VA Medical Center, Salt Lake City, UT.

Patients with cardiovascular disease can derive significant benefit from the implementation of risk reduction therapies. The American Heart Association has urged the medical community to promote comprehensive risk reduction in eligible patients. To address this mandate, a multidisciplinary team at the VA medical center formed a cardiovascular risk reduction clinic (CRRC).
PURPOSE: To provide a baseline assessment of the CRRC's ability to

successfully reduce cardiovascular risk factors.
METHODS: An audit of 30 randomly selected clinic patients was done. Data were collected from CRRC charts.
RESULTS: Thirty patient (29 male, 1 female) charts were reviewed. The mean patient age was 59 (range 44-77) years. Seventeen patients had been discharged from our clinic and placed in primary care clinics at the time of the audit. Patients averaged six CRRC visits and 10 months in clinic. Twenty-nine patients had established coronary artery disease (31 myocardial infarctions, 29 PCTA or CABG). One patient was seen for primary prevention. Thirty patients received aspirin. Twenty-two of the 30 patients (73%) were receiving β-blocker therapy. Twenty out of 28 patients (71%) achieved a low-density lipoprotein goal of less than 100 mg/dl. Nineteen of the 23 hypertension patients (83%) achieved blood pressure goals. Seventy-three percent of patients were not smoking. Seventy percent of patients were free of chest pain. Fifty percent of patients had an average weight loss of six pounds.
CONCLUSIONS: This audit has provided the CRRC with valuable benchmarking information that will be utilized in improving patient care and developing a cardiac risk reduction database for outcomes research. A 1-year follow-up audit is planned.

Critical Care

213. Pharmaceutical care provided to medical intensive care unit patients. *David Williamson, B.Pharm., M.Sc.*, Pierre Martineau, M.Sc., Pharm.D., BCPS, Chantal Pharand, Pharm.D., BCPS; Hôpital du Sacré-Coeur de Montréal, Université de Montréal, Montréal, PQ, Canada.

PURPOSE: To document pharmaceutical care activities provided to medical intensive care unit (MICU) patients evaluate: 1) number and type of interventions, 2) physician acceptance of recommendations, and 3) drug and laboratory cost savings.
METHODS: Data on drug-related problems identified types of interventions performed. Savings in drugs and laboratory tests were documented by the senior pharmacy resident over a 12-week period. Savings in drug costs were calculated for a 72-hour period, half of the average length of stay, after the intervention.
RESULTS: Over a 12-week period, 133 patients were followed. A total of 436 interventions were performed (mean eight interventions per day), with an acceptance rate of 97%. The most frequent drug-related problems identified were: patient uses an unnecessary medication (21.8%), patient does not receive the medication appropriately (18.1%), and patient receives a dose that is too high (17.9%). The most frequent interventions performed were: drug information (45.3%), decrease drug dosage (12.6%), and stopping medication (11.7%). The total cost-avoidance estimate, laboratory tests included, for the study period and extrapolated to one year were $7320 Canadian ($5051 U.S.) and $22,265 Canadian ($15,363 U.S.), respectively.
CONCLUSIONS: This pilot project demonstrates that pharmaceutical care services provided to MICU patients enables both the identification and solving of numerous drug-related problems and generates substantial costs savings. Broadening of this service to include surgical intensive care unit patients will be the object of further studies. The savings generated might fully compensate for the salary of a full-time pharmacist.

214. Outcomes of pharmacist-initiated clinical interventions in a community hospital critical care unit. *Theodore G. Barlows, III, Pharm.D.*, L. Leanne Lai, Ph.D., Lourdes M. Blanchard, Pharm.D.; Nova Southeastern University, Ft. Lauderdale, FL; Baptist Hospital of Miami.

PURPOSE: The goal of this study was to determine if a shared faculty-pharmacist's (SFP) participation on a multidisciplinary rounding team impacted the cost and utilization of medical services in a community hospital critical care unit (CCU).
METHODS: The study was a 2-year retrospective review of data with a quasi-experimental design. The SFP participated in rounds at a non-profit community hospital CCU located in South Florida. Study subjects were all patients admitted to the CCU during 1996 (pre-SFP services) and 1997 (with SFP services). During 1997, all SFP-initiated drug therapy interventions were documented on a computer database. APACHE III score was used as the baseline measurement to compare the disease severity of patients during the study period. Nonparametric Mann-Whitney U tests and chi squared statistics were used to test differences between pre- and post-SFP pharmacy services in all outcome variables.
RESULTS: The results demonstrated: 1) no significant difference in APACHE III scores (48.7 vs 49.5, p=0.33); 2) 5% reduction in the average CCU length of stay (LOS; 3.9 vs 3.7 days, p=0.38); 3) 2% reduction in the average hospital LOS (12.4 vs 12.2 days, p=0.78); 4) 9% reduction in CCU mortality (7.6% vs 6.9%, p=0.44); 5) 7% increase in hospital mortality rate (13.8% vs 14.3%, p=0.64); and 6) $109,000 in drug cost savings resulting from 266 SFP pharmaceutical care interventions.
CONCLUSION: The study revealed a significant reduction in drug costs as a result of SFP interventions. Furthermore, there was a non-statistical reduction in LOS and CCU mortality during the study period.

215. Evaluation of pharmacy students' and residents' clinical interventions on a critical care rotation. Dora C. Lee, Tara L. Belden, Steven R. Erickson, Pharm.D., Keila M. Samuels, Pharm.D., Frank J. Ascione, Pharm.D., Ph.D., *Lynda S. Welage, Pharm.D.*; University of Michigan, Ann Arbor, MI.

PURPOSE: This study was designed to 1) assess the impact that students and residents have within critical care, and 2) facilitate the development of curricular objectives designed to optimize drug-related problem identification.
METHODS: Pharmacy students and residents who were assigned to the trauma burn service between August 1996 and April 1997 documented their clinical interventions utilizing a standardized data collection card. Specific information regarding each intervention included classification of the intervention, a description of the intervention, and whether the intervention was accepted.
RESULTS: Twelve students and three residents documented 363 interventions during seven rotations. The average number of recommendations provided by students and residents was 17.75 ± 12.4 and 50 ± 35, respectively. The most frequently documented intervention involved the initiation of a therapeutic agent, accounting for 14% of the interventions. In contrast, drug-drug interactions and adverse drug reactions interventions were less commonly reported, each accounting for only 3% of the total interventions. About 87% of the recommendations were completely accepted by the physician, 3.6% were taken partially, 4.9% were not accepted, and 5% were indeterminate. The most common therapeutic categories addressed included antibiotics, anticonvulsants, and anti-ulcer medications.
CONCLUSIONS: 1) Based on the study results, it appears that students and residents can make significant contributions to the health care of critically ill patients, and 2) the type of interventions suggested vary significantly, which may reflect which ones are most discussed during the students' education.

216. Impact of education and practice guidelines for propofol use in the surgical intensive care unit. *K.O. Petros, Pharm.D.*, N.W. Knudsen, M.D., M.W. Sebastian, M.D., D.A. Lubarsky, M.D.; Duke University Health Systems, Durham, NC.

PURPOSE: Critically ill patients in the surgical intensive care unit (SICU) frequently exhibit signs of uncontrolled pain and anxiety. This leads to increased agitation, sleep deprivation, and high levels of catecholamine release impeding patient care and recovery. While other agents are available, propofol had become increasingly used in our SICU. With physician consensus and IRB approval, we developed and implemented guidelines for appropriate propofol use and patient selection.
METHODS: Propofol use was reviewed for a 2-month period prior to implementation of guidelines (group 1). Attending physicians, residents, and nursing staff were educated on the guidelines and guidelines were available at all patient bedside workstations. The same clinical pharmacist attended daily rounds and intervened when guidelines were not followed. Physicians were given daily feedback on compliance. One month after implementation, usage data were reviewed demonstrating a significant reduction in propofol use (group 2). Education was considered effective and daily review was ceased. Usage data for the month following were evaluated to assess continued compliance.
RESULTS: Patient charges for group 1 totaled $23,750/month. A significant reduction to $12,500/month (47%, p=0.01) was demonstrated with group 2. The effects of the guidelines were short-lived as, without daily scrutiny for adherence, usage increased from baseline to $30,875 (group 3).
CONCLUSION: Implementation of guidelines for use of propofol are not sufficient to control use and cost of care for SICU patients. The value of clinical pharmacist review and provision of timely feedback to prescribers is crucial to change practice patterns on a consistent basis.

Education

217. Assessment of a scannable patient care activity record tracking system to document pharmacy student interventions: preliminary analysis of a 4-year project. *George E. MacKinnon, III, M.S.*; Midwestern University, Glendale, AZ.

PURPOSE: This study describes a method for documenting contributions of pharmacy students while completing rotations. Goals were to: 1) investigate the utility of a scannable patient care activity record (PCAR) tracking form; 2) evaluate the most common reasons for interventions, actions taken, recommendations and their acceptance, and time involved; and 3) demonstrate student contribution to patient care.
METHODS: Baccalaureate and Pharm.D. students documented rotation interventions. Interventions consisted of identifying existing or potential problems related to medication therapies or providing or soliciting additional information that aids in the management of patient therapy. Interventions were collected from various settings: ambulatory, community, hospital, and long-term and home health care sites. Students self-reported and returned PCAR forms to the college. Data analysis includes descriptive, inferential, and hypothesis testing, as well as nonparametric methods.

RESULTS: A total of 22,109 forms were returned from 475 students resulting in 21,783 scannable forms (average of 46 forms per student). The most common reasons cited of the 27,912 interventions were: drug regimen selection 6841 (24.50%), request for information on medications or patients 5605 (20.01%), and patient condition or laboratory value warrants medical attention 3181 (11.40%). Actions taken resulted in 8935 (36.05%) contacts to health care providers and provision of drug information to practitioners and patients 8893 (35.88%). The majority of interventions were initiated by students 13,428 (59.46%), accepted in 12,793 (60.94%) cases, and took less than 5 minutes 8872 (44.26%).
CONCLUSIONS: The PCAR tracking system appears to be a convenient way to collect pharmacy student intervention data to quantify and qualify the value of pharmacy students at practice sites.

218. Academic detailing: a tool in improving prescribing practices. *Alice E. Taku, Pharm.D.*, Mark D. Winton, M.D., Charles Landsbaum, M.D., Rich Lee, B.S.; Xavier University, New Orleans, LA; St. Mary's Health Center, Jefferson City, MO.

PURPOSE: This paper discusses the concept of academic detailing, or educational outreach, as carried out at a 187-bed Midwestern community hospital; and to summarize the evidence of its effectiveness in improving prescribing practices, specifically those involving the excessive use of third generation cephalosporins.
METHODS: The concept of academic detailing was learned at three learning sessions sponsored by the Institute for Health Care Improvement (IHI) in Boston. These learning sessions were part of a 10-month IHI collaborative involving 38 health care organizations with a focus on improving prescribing practices. A team of six heath care providers (including physician experts, pharmacists, and the chief executive officer) was formed at our hospital; it met bi-weekly to plan and review progress. The academic detailing (person-to-person education) to physician prescribers regarding third generation cephalosporins was done by a clinical pharmacist, accompanied by supportive educational materials and efforts to reinforce the detailing sessions.
RESULTS: Pre-intervention usage of third generation cephalosporins compared to post-intervention usage at the end of the 10-month collaborative. A 40% decrease in third generation cephalosporin usage was realized, as well as a 40% decrease in dollar expenditure.
CONCLUSION: Academic detailing is a concept that has been greatly underutilized. While the process itself can be time consuming and requires a dedicated person for detailing, as well as the backing of authoritative and credible experts, its effectiveness is definitely unquestionable.

Endocrinology

219. Development and implementation of a diabetes management program by a community pharmaceutical care resident. *Tammy S. Bullock, Pharm.D.*, Matthew C. Osterhaus, B.S., Jay D. Currie, Pharm.D., Randal P. McDonough, M.S.; University of Iowa, Iowa City, IA; Osterhaus Pharmacy, Maquoketa, IA.

PURPOSE: Community pharmacists are in a unique setting to identify patients at risk for the development of health problems and those that need additional medical attention. In order to expand their role as a member of the health care team and improve patient care quality, a diabetes education and management program was developed and implemented in a community pharmacy.
METHODS: American Diabetes Association guidelines were used for the development of the program. The program is composed of multiple elements that span the needs of the patient, pharmacist, and organization. These include patient education methods and materials, focused pharmacist education on the management of diabetes, and marketing and reimbursement strategies. Patient education services can be provided individually or as a comprehensive program. These services include survival skills, blood glucose monitor training, insulin injection training, medication management, diet and exercise education, ongoing blood glucose monitoring, long-term complication education, and sick day management. The pharmacist education program included assessment and remediation of pharmacist diabetic knowledge, primary literature, and discussion groups. The marketing and reimbursement program will target community groups and physicians in addition to diabetic patients.
RESULTS: HgA_{1c} and blood glucose will be collected and overall changes in control will be evaluated. Patient satisfaction and quality of life will be measured at the beginning and end of enrollment in the program.
CONCLUSIONS: Program results will show the impact of a pharmacist-centered diabetes management program on the blood glucose control and quality of life of diabetic patients.

220. Multidisciplinary certification for diabetes outpatient educators in Rhode Island. *Michael L. Simeone, MBA*, Paul J. DiBiase, Jr., B.S., Amy C. Rogowski, B.S.; University of Rhode Island, Kingston, RI; Oxnard Pharmacy.

PURPOSE: This abstract describes the development of a multidisciplinary certification process by the State of Rhode Island Department of Health for diabetes educators, which includes reimbursement to pharmacists for cognitive services.
METHODS: The State of Rhode Island Department of Health developed a formal process by which registered nurses, dietitians, and pharmacists are eligible to become certified diabetes outpatient educators (CDOE). Prior to application submission, pharmacists attend a 30 contact hour University of Rhode Island College of Pharmacy diabetes certificate program. The steps in the process include completion of a formal educational component, observation of a 12-hour diabetes outpatient group program, and supervised presentation of a topic related to the candidate's area of expertise as part of a program. The candidates must then pass, with a minimum grade of 85%, a diabetes outpatient educator (DOE) certification examination. The identical examination is given to all candidates regardless of their discipline. In addition, there are several annual requirements that must be completed to maintain DOE certification. Third party insurer reimbursement for diabetes education performed by CDOEs was mandated by state legislation on January 1, 1997.
RESULTS: For the examination offered in May 1998, the passing rates for the three disciplines were as follows: nurses, 24%; pharmacists, 53%; and dietitians, 70%. Eight pharmacists became eligible to obtain provider numbers from third party insurers.
CONCLUSION: The development of a state-mandated certification process for diabetes outpatient educators in Rhode Island has made possible the reimbursement of pharmacists for cognitive services.

Gastroenterology

221. Constipation management in the developmentally disabled: impact of prescribing by a clinical pharmacist. *Sharon M. Tramonte, Pharm.D.*, William H. Benefield, Jr., Pharm.D., FASCP, BCPP, David R. Hazlett, M.D.; The San Antonio State School; University of Texas at Austin; University of Texas Health Science Center at San Antonio, San Antonio, TX.

PURPOSE: A clinical pharmacist performs drug therapy management under protocol at a 320-bed ICF-MR facility for the developmentally disabled. The protocol serves as the standing delegation order by a physician in the facility for the pharmacist to perform all necessary activities related to drug therapy management of constipation. Clinical privileges allow ordering new, adjusting, or discontinuing current laxative therapy for the management of constipation.
METHODS: In this patient population, constipation poses a therapeutic challenge secondary to medications, diet, ambulatory status, and the underdevelopment of the gastrointestinal tract. Twenty-two patients were managed by the clinical pharmacist. Measured outcomes included number of bowel movements (BMs) per week, number of medications administered per week, and cost of therapy. All laxative regimens were consolidated from multiple laxatives to the daily use of PEG-electrolyte solution at the clinical discretion of the pharmacist.
RESULTS: All but one patient responded positively to the change in therapy. BMs remained the same or were increased in 74% of patients. BMs were decreased in 11%, but remained above a minimum of three BMs per week. The number of laxatives was decreased an average of two medications per patient. The number of medications administered by the nurses was drastically decreased thereby decreasing their work load. Cost savings for this small number of patients was greater than $15,000 per year.
CONCLUSION: The prescribing protocol and its impact on improving patient care and lowering cost at our facility is described. Qualitative and quantitative data will be presented to support the impact of this progressive practice.

Geriatrics

222. Incontinence care: epidemiologic and economic evaluations. *L. Pazzagli*, R. Vanfi, L. Ferraro, E. Fiorio, E. Marrazzo, C. Pietraru, F. Benvenuti; Farmaceutica Istituto Ortopedico Toscano; I.N.R.C.A., Firenze, Italy.

Incontinence is a major care problem in home care and a prevalent costly health condition, because it affects more than 200,000,000 people in the world. Limited data are available documenting the prevalence and different costs of incontinence. It is necessary to obtain an accurate assessment about levels and patterns of incontinence so projects to reduce it can be developed. In Italy, most costs of incontinence are granted by the National Health System (NHS).
PURPOSE: This paper reports some preliminary results of a study evaluating epidemiologic data about incontinence in the area of two similar Italian towns, Firenze and Torino.
METHODS: The pharmacy department is involved in home care and distributes to incontinent patients several incontinence aids such as absorbent products, urinary catheters, external catheters, and other devices. In the sanitary districts studied, the pharmacy services provide assistance to 11,780 patients affected by incontinence, of a total of 1,765,000 inhabitants.

RESULTS: The global cost for the NHS in the period January-September 1998 was about $3,652,695, with a charge of $311 per individual.
CONCLUSION: The lack of published data is surprising, but they are important for public health care organizations in decision making related to incontinence management. We plan also to collect data, using a special questionnaire, from other countries to have an international analysis of different interventions for incontinence management.

223. Clinical pharmacy services improve patient care and reduce costs in a transitional care unit. *Sheryl L. Follin, Pharm.D., BCPS*; Exempla Saint Joseph Hospital; University of Colorado Health Sciences Center, Denver, CO.

PURPOSE: Transitional care units (TCUs) are a cost-effective bridge to home or alternate care for subacute patients. Laws governing TCUs fall under the auspices of long-term care facilities; however, the pharmacy consultant role may be inadequate for the more complex TCU patient's needs. Therefore, we implemented a program which increased pharmacy involvement in the TCU in an effort to improve the identification and correction of drug-related problems (DRPs).
METHODS: In July 1996, a program was implemented which required a pharmacist's review of all patient medications on admission to the TCU and with each new medication order, review of the patient's chart within 48 hours of admission and at least once a week thereafter, and attendance at all interdisciplinary patient care meetings.
RESULTS: The numbers of TCU admissions pre-program (May 1995-April 1996) and post-program (July 1996-June 1997) were 274 and 335, respectively. Program implementation resulted in a significantly higher number of DRPs identified per admission compared to pre-program (0.97 vs 0.28; $p<0.001$ by t-test). In addition, the percentage of patients receiving at least one medication consult increased from 79% to 99%. During the second year of the program (July 1997-June 1998), there was a decrease in the number of DRPs identified per admission compared to the previous year (0.71 DRPs/admission). This decrease was partially attributed to targeted physician education. Implementation of the program required an average of 2-3 hours pharmacist time per day and resulted in cost-savings of approximately $15,000 the first year and $23,000 the second year.
CONCLUSION: Increasing pharmacy involvement in a TCU can significantly improve patient care and result in cost savings.

224. Medication assessment by a multidisciplinary consultation service in elderly, ambulatory veterans at risk for falls. *Suzanne F. Machuca, Pharm.D.*, G. Tyler Jamison, Pharm.D., Mark B. Burlingame, Pharm.D., David T. Lowenthal, M.D., Ph.D., Angel H. Herrera, M.D., Vineesh Bhatnagar, M.D., Barbara S. Chong, Pharm.D., Shanon Lees, Pharm.D., Javier Maruenda, M.D.; Veterans Affairs Medical Center, Gainesville, FL.

PURPOSE: The causes of falls in elderly patients are often multifactorial in nature necessitating a multidisciplinary approach to assessment and prevention. For the purpose of assessing elderly, ambulatory veterans at risk for falling, we implemented a gait and balance referral clinic staffed by physical therapy, medical, and clinical pharmacy personnel. Various medications have been implicated as contributing to an increased fall risk in elderly patients. We report the results of medication assessment in patients referred to our clinic.
METHODS: On the appointment day, patients are evaluated by each member of the gait and balance team (i.e., pharmacist, physician, physical therapist). Following evaluation, the team meets to discuss findings and recommendations. Recommendations are forwarded to the patient's primary care physician. We evaluated the medication regimens of 57 consecutive patients, age 76 ± 5.4 years (mean ± SD), referred to our clinic.
RESULTS: Initially, patients were taking 8.3 ± 4.0 total medications and 3.8 ± 2.3 medications that have been associated with falls. Antihypertensive and psychotropic medications were being used by 67% and 44% of patients, respectively. Most (93%) patients were taking medication that has been associated with falling although medication was assessed as a major contributor in only 25% of patients. Medication changes were recommended in 30 (53%) patients with 28 of 64 (44%) recommendations implemented by completion of the first follow-up visit with the primary care physician.
CONCLUSIONS: The majority of fall risk in our patients resulted from other factors. However, the widespread use of medications associated with falls in this population underscores the importance of medication assessment.

225. Economic and clinical effects associated with clinical pharmacy services in a geriatric outpatient clinic. *Sybelle A. Blakey, Pharm.D., BCPS*; Mercer University Southern School of Pharmacy, Atlanta, GA.

PURPOSE: Medication-related problems are common in the geriatric population due to polypharmacy and age-related physiologic, pharmacokinetic, and pharmacodynamic changes. This report describes economic and clinical effects associated with clinical pharmacy services in a once-weekly multidisciplinary geriatric outpatient clinic.
METHODS: Patients seen by the geriatric outpatient clinic from December 1997 through July 1998 were triaged by a multidisciplinary team that included a clinical pharmacist. The clinical pharmacist identified potential and actual medication-related problems. Changes in drug therapy were made in collaboration with the primary care provider.
RESULTS: Patients were seen from December 1997 through July 1998. Medication-related problems were identified as follows (220 total): 112 (51%) medication use without indication, 25 (11.4%) untreated indication, 21 (9.5%) adverse drug reaction, 21 (9.5%) overdosage, 17 (7.7%) improper drug selection, 8 (3.6%) duplication, 8 (3.6%) laboratory monitoring needed, 7 (3.2%) subtherapeutic dosage, and 1 (0.5%) drug interaction. The acceptance rate for pharmacist-recommended changes in drug therapy was 98.6%. The 1-year cost avoidance from discontinuation of medications was $18,260.30. The average number of medications per patient was decreased from 11 to 7. Clinical effects of drug therapy changes were reported to be positive in 46.8%, neutral in 52.7%, and negative in 0.5% of cases. Assessment of clinical effects included both improvements reported by the patient or caregiver and those assessed by a clinician.
CONCLUSION: Clinical pharmacy services in a geriatric outpatient clinic decreased both medication costs and the number of medications per patient. Changes in drug therapy resulted in neutral or positive clinical effects in the majority of patients.

226. The impact of a pharmacy school clinical consultative service on a geriatric office practice. *Randall C. Rowen,, Pharm.D.*, Victor A. Hirth, M.D., Elizabeth Currence, Pharm.D. candidate, Kimberly Harrison, Pharm.D. candidate; University of South Carolina, Columbia, SC; Richland Senior Primary Care Practice.

PURPOSE: Geriatric patients are high consumers of drugs. High drug usage frequently produces medication-related problems (MRPS) and excessive health care costs. A new consultative service, provided by a pharmacy school clinical faculty member and students (CFMS), was recently implemented at a geriatric office practice to assist with patient management. Patterns of drug use, cost, and appropriateness of drug therapy were evaluated.
METHODS: Patients were referred by geriatricians and seen by CFMS at the physicians office. Prior to the appointment, CFMS reviewed medical records and prepared patient educational materials. At the appointment, a medication history and counseling was performed by the CFMS. Within one week of the appointment the information was evaluated and a written consultative report was provided to the referring geriatrician.
RESULTS: Ten Caucasian patients (five male) who averaged 75.9 years were referred to CFMS. According to the medical record, the patients averaged 7.2 diagnoses, took 11.6 medications (78% scheduled, 22% PRN) at an average cost of $374.25 per month. Interestingly, medication histories indicated patients were taking an average of 12.8 medications (74% scheduled, 26% PRN). CFMS provided 107 drug therapy recommendations (10.7 per patient), of which 89.7%, 47.7%, and 1.3% were accepted, implemented, and rejected, respectively. CFMS recommendations resulted in a monthly cost savings of $109.32 per patient.
CONCLUSION: A university-based pharmacy consultative service provided to an office-based geriatric practice can solve many medication-related problems, significantly reduce costs, provide an educational opportunity for students, and is well accepted by physicians and patients.

HIV/AIDS

227. Development and justification of a pharmacist-based HIV medication adherence referral clinic. *Kathleen K. Graham, Pharm.D.*, Lucas H. Beeler, Pharm.D., Crystal L. Plasencia, Pharm.D., Michael G. Sension, M.D., Stephen Renae, M.D.; Nova Southeastern University; North Broward Hospital District, Fort Lauderdale, FL.

PURPOSE: To describe the development, delivery, pharmacist interventions, patient outcomes, and justification of our pharmacist-based HIV medication adherence referral clinic.
METHODS: Our medication adherence clinic is part of a county HIV primary care clinic. The program began in 1995 as a pilot project in which a pharmacist volunteered one half-day per week to provide medication counseling to HIV-infected individuals. This expanded to two half-days per week, followed by a request for additional pharmacist time. In order to justify a funded pharmacist position, the following project was designed. Adult HIV-infected patients with a history of or risk factors for medication nonadherence were referred to our clinic for medication counseling. We identified risk factors for nonadherence, set up a pillbox, provided a written schedule, documented interventions, and scheduled follow-up visits. We evaluated patient outcome comparing the percentage of patients with undetectable viral loads (less than 400 copies/ml) prior to pharmacist counseling vs after pharmacist counseling.
RESULTS: We counseled 122 patients from January to December 1997. Sixty percent of visits resulted in pharmacist intervention and a significantly higher proportion of patients achieved an undetectable viral load on subsequent therapy after the pharmacist counseling clinic. These results were presented in Geneva at the World AIDS Conference and to our administration. Based on the positive impact on patient outcome and the demand for more pharmacist time in the clinic, we were granted a pharmacist position for the counseling program.

CONCLUSIONS: Pharmacist demonstration projects which document the value of clinical pharmacy services using outcome measurements can justify new pharmacist positions.

228. Medication errors in hospitalized patients with HIV infection: impact of an HIV pharmacist. *Paula A. Teichner, Pharm.D.*, Kevin W. Garey, Pharm.D.; Michael Reese Hospital; University of Illinois at Chicago, Chicago, IL.

HIV pharmacotherapy demands strict adherence to current guidelines to ensure optimal outcomes. With the increasing complexity of treatment regimens, the likelihood of medication errors increases.
PURPOSE: To document the frequency of medication errors and demonstrate the value of an HIV pharmacist in hospitalized patients with HIV infection.
METHODS: All HIV-infected patients admitted to an urban, teaching hospital who were prescribed antiretroviral therapy were identified by daily review of medication orders. Inpatient medications were compared with outpatient regimens and were assessed by the HIV pharmacist for accuracy and appropriateness. Medication errors were documented and interventions were suggested, if necessary. Significance of the intervention was assessed by three separate HIV specialists, a physician, a nurse, and a Pharm.D.
RESULTS: During the 5-month study period, there were 68 medication errors requiring pharmacist intervention for 60 hospital admissions. Seventy-five percent of admissions required at least one intervention, with 13% requiring greater than two interventions. Clinical interventions prevented adverse events due to drug-drug or drug-food interactions (27%), underdosage (20%), overdosage (5%), wrong drug ordered (17%), medication not prescribed that the patient was on prior to admission (17%), and miscellaneous (14%). Interventions were most frequently associated with indinavir (21%), saquinavir (7%), and zidovudine (7%). Ninety-three percent of the pharmacists' recommendations were implemented. Ninety-four percent of the interventions were considered significant by the HIV care providers, with 50% rated as very significant.
CONCLUSION: Medication errors are common in hospitalized HIV-infected patients receiving antiretroviral therapy. A clinical pharmacist with specialty training in HIV pharmacotherapy can significantly impact on the care of these patients.

229E. Impact of pharmacist interventions in an ambulatory HIV clinic. *Mark A. Douglass, Pharm.D.*, Charles E McPherson, Pharm.D., Sutthiporn Pattharachayakul, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

Presented at the 30th Annual Canadian Society of Hospital Pharmacists Professional Practice Conference, Toronto, ON, Canada, January 31-February 4, 1999.

230. Development and integration of clinical pharmacy services into a medically indigent, multidisciplinary clinic for patients with HIV infection. *Patrick G. Clay, Pharm.D.*, R. Chris Rathbun, Pharm.D.; University of Oklahoma, Oklahoma City, OK.

PURPOSE: Adherence to highly active antiretroviral therapy imposes complex administration schedules for patients but is imperative for optimal outcomes. Retrospective evaluation of virologic outcomes in our HIV clinic population revealed that only 54% of patients had achieved a viral load less than 400 copies/ml (RT-PCR). Implementation of an innovative clinical pharmacy service within a primary care clinic for patients with HIV infection to improve treatment outcomes is described.
METHODS: Prospective clinical pharmacy services were established within a Ryan White Title IIIb clinic serving approximately 550 patients with HIV infection. Primary functions include: 1) comprehensive chart reviews prior to all patients' scheduled visits; 2) patient interviews focusing on medication histories during clinic appointments; 3) initiation and maintenance of medication flow sheets, documenting current and historical antiretroviral exposure and concomitant medications; and 4) charting interview results and recommendations on each patient's progress note. Patient interviews are utilized to evaluate appropriateness of administration practices and to assess adherence and adverse events.
RESULTS: In the four months since inception of this service, 374 patient interviews have been conducted. Presence of pharmacy staff within the clinic allows medication and adherence issues to be addressed promptly, minimizing the potential for drug interactions and adverse events. Practitioners now rely heavily on these services to base treatment decisions.
CONCLUSIONS: These clinical pharmacy services have been well received by practitioners and have been incorporated into the daily functions of this university-based clinic. The impact of these services on treatment outcomes is being assessed.

231. Impact of pharmaceutical care on outcomes in HIV-infected individuals. *Kathleen M. Melbourne, Pharm.D.*, Susan L. Brown, Pharm.D., Robert L. Dufresne, Ph.D., BCPS, BCPP, Sandra M. Geletko, Pharm.D., BCPS, Alvan Fisher, M.D.; University of Rhode Island; Coastal Medical, Inc., Providence, RI; Brown University.

PURPOSE: The objective of this study was to evaluate the impact of clinical pharmacists' interventions in a private physicians' group practice on medication knowledge (K), adherence (A), and patient satisfaction (PS) in HIV-positive patients who were prescribed protease inhibitor (PI)- and nucleoside analogue (NA)-containing regimens.
METHODS: Fifty patients were randomized to either a control (standard care) or an intervention group (monthly visits with a clinical pharmacist, including education, adherence counseling, resolution of medication problems, and collaboration with other providers). Knowledge of PI and NA was assessed by an investigator-developed questionnaire and scored from 0-35. Adherence to PI and NA regimens was evaluated similarly and scored from 0-20; patient satisfaction was scored on a scale of 11-55. All parameters were assessed at baseline, and at 1, 2, 3, and 6 months. The change in mean scores for K, A, and PS over a 6-month period were compared between the two arms using MANOVA.
RESULTS: Forty-five patients completed the study. The groups were similar in demographics. From baseline to months 2 and 6, there was significant improvement in K-PI, K-NA, and A-NA in the intervention group but not in the control group (K-PI: 19-28-31 vs 21-21-21, $p<0.0001$; K-NA: 22-28-30 vs 17-18-18, $p<0.0001$; A-NA: 15-18-18 vs 15-15-14, $p=0.001$). Patient satisfaction with care scores for the intervention vs the control groups were: 52-52-53 vs 52-49-49; $p=0.629$.
CONCLUSIONS: Interventions by clinical pharmacists significantly improved medication knowledge and adherence in HIV-infected patients on complex antiretroviral regimens in a private physicians' group practice, while preserving patient satisfaction with care.

Infectious Diseases

232. Community-acquired pneumonia evaluation of a diagnostic-therapeutic pathway. L. Pesce, *M. Sano*, C. Iaru, J. Van Vleet, N. Bagarolo, R. Rampazzo, A. Pedrini; Pfizer Italy, Rome, Italy; Pfizer U.S.

PURPOSE: To rationalize the resources and improve the quality and effectiveness of health care, it is necessary to identify and evaluate the characteristic pathways of diagnosis and therapy for each clinical case. Therefore, data collection about the distribution of certain pathologies, the various treatment strategies employed in treating these pathologies, and their budgetary impact is very important.
METHODS: Clinical and economic data collection was performed using software developed by Pfizer (pneumonia data entry). More than 50% of the patients hospitalized with the diagnosis of community-acquired pneumonia (CAP; DRG 89 and 90) were sampled. Patient records at Camposampiero and Cittadella hospitals from 1996 were evaluated. The economic analysis, consisting of pharmacology, laboratory, radiology, and comorbidity data, performed using another Pfizer program (therapy cost). In this study, therapy cost was used to perform a cost-effectiveness analysis of different clinical treatments for CAP.
RESULTS: The results of the study give a description of the current clinical practice for the treatment of CAP at Camposampiero and Cittadella hospitals. The budgetary impact is based on the identification of the effective costs of CAP management. The patient sample consists of an elderly population (average age = 73 years) with a high incidence of comorbid conditions (79%). The patient sample was equally distributed among males and females. All patients received chest X-rays (1.9 per case) and complete blood count analysis (2.4 per case), but microbiologic evaluation of the blood, sputum, etc. was infrequent. The average length of hospitalization was 15.4 days. The mean length of antibiotic therapy was 14.3 days. The average cost per hospitalization day was £520,000, of which only 3.5% represented antibiotic costs. The total cost of the hospitalization averaged £8 million, much higher than the hospital's DRG reimbursement.
CONCLUSION: In today's health care environment, where total cost of care is becoming increasingly more important, it is imperative to identify efficient clinical care. This kind of study promotes discussions among multidisciplinary clinical teams regarding the optimization of clinical practices. The therapy cost software calculates the cost effectiveness and budgetary impact of different clinical approaches. This provides clinicians with valuable information, so they can improve the quality of care and reduce resources consumed when treating a patient with CAP.

233. Pharmacist-managed compassionate use protocol for treatment of vancomycin-resistant *Enterococcus faecium* infections. *Larissa R. Graff, Pharm.D.*, Victoria J. Dudas, Pharm.D., Scott M. Fields, Pharm.D., Alexandra E. Hilts, Pharm.D., Karen A. Kostiuk, Pharm.D., B. Joseph Guglielmo, Pharm.D.; University of California San Francisco, San Francisco, CA.

PURPOSE: Pharmacist management of compassionate use protocols (CUP) in the therapy of difficult-to-treat infections is not well characterized. Presence of CUP allows for successful treatment of infections unresponsive to approved antibiotics. The following summarizes our experience with a pharmacist-directed CUP of quinupristin/dalfopristin (Q/D) for treating vancomycin-resistant *Enterococcus faecium* (VREF) infections.
METHODS: Infectious diseases-trained clinical pharmacists are primarily responsible for all facets of this protocol, including institutional review board

(IRB) approval, screening patients for protocol entry, obtaining authorization for use, patient consent, coordinating drug preparation, monitoring for efficacy and toxicity, completing case report forms, reporting serious adverse events, and summarizing results for the IRB and sponsoring company.
RESULTS: During the period October 1995 through October 1998, 59 patients were treated with Q/D. The majority of patients (n=53) were treated with Q/D for VREF infections and six patients were enrolled in the study for treatment of other gram-positive infections in patients intolerant to conventional therapy. Among the 53 patients treated for VREF infections, the overall clinical success rate was 68%. Three patients (6%) failed therapy and response was indeterminate in 14 patients (26%). The most common sources of infection were intraabdominal (36%), bacteremia (unknown origin; 23%), urinary tract/urosepsis (17%), and central catheter-associated bacteremia (15%). The most common adverse effects were myalgias (23%) and arthralgias (15%).
CONCLUSION: Pharmacist management of an investigational drug protocol offers value to the institution in the therapy of normally untreatable infections.

234. Antibiotic utilization in a government employer group: benchmarking against peer groups. *Gene T. Jay, Pharm.D.*; Merck-Medco Managed Care, Montvale, NJ.

PURPOSE: In a managed care environment, clinical pharmacists frequently need to benchmark their plan's data to uncover areas where prescribing can be improved. As a large, national pharmacy benefit manager, we modeled government employee plans (GEP) from our national database to develop a benchmark of antibiotic utilization in this market segment. We compared the local plans' usage data against the composite of national peer groups.
METHODS: Antibiotic claims data for the GEP and composite peer groups from July 1, 1997 through June 30, 1998 were extracted from our national claims database via our own proprietary software. Peer plans were selected out of our database of government employer clients. The plan must have a full drug program, a full year of data for the selected time frame, dependent eligibility, and a sufficiently large size to be modeled in this analysis.
RESULTS: Our benchmark model consisted of seven GEP peers, representing 1,385,221 total members and over $26,000,000 in antibiotic drug expenditures for common antibacterials.

	Costs (per member per year)		No. Prescriptions (per 1000 members)	
	Peer	Plan	Peer	Plan
First line				
Penicillins	$1.36	$2.09	162.45	275.16
Erythromycins	$0.40	$0.59	33.33	54.98
Sulfonamides	$0.59	$0.66	59.64	83.29
Tetracyclines	$2.15	$2.97	62.23	76.85
First-line cephalosporins	$3.18	$3.64	88.57	98.25
Urinary tract	$0.87	$0.76	38.61	24.76
Total first line	$8.55	$10.71	444.84	613.29
Second line				
Second-line cephalosporins	$3.88	$3.57	58.46	44.88
Augmentin®	$2.88	$2.95	42.66	40.15
Second-line macrolides	$5.47	$5.23	112.46	97.64
Fluoroquinolones	$4.90	$6.26	74.19	90.77
Total second line	$17.12	$18.02	287.77	273.43
Grand total	$25.68	$28.73	732.61	886.72

CONCLUSIONS: Despite a favorable ratio of first- to second-line antibiotic usage, the plan had more prescriptions per 1000 members than the peers, and higher overall costs based on average wholesale price per member per year. Fluoroquinolone utilization appears particularly excessive.

235. Cefepime utilization and step down dosing in place of ceftazidime in febrile bone marrow transplant, leukemia, and solid tumor patients. *Steven P. Smith, Pharm.D.*, Susan E. Beltz, Pharm.D., Melissa L. Johnson, Pharm.D., John R. Wingard, M.D., Frederick M. Weeks, M.D., James W. Lynch, M.D., Reuben Ramphal, M.D.; Shands at the University of Florida, Gainesville, FL.

PURPOSE: Ceftazidime's clinical activity against gram-negative rods (GNR) at our institution was decreasing, with subsequent increases in imipenem usage. Cefepime is a new cephalosporin resistant to certain GNR β-lactamases. We replaced ceftazidime with cefepime as monotherapy in the febrile neutropenic patient. In addition, based on adequate MICs for a 1 g dose, we reduced the initial dose from 2 g to 1 g if the patient was stable and not infected with pseudomonas.
METHODS: Febrile cancer patients, neutropenic or not, were started on cefepime 2 g IV q8h, adjusted for renal function. If within 24-72 hours, the patients were culture negative or positive for any bacteria except pseudomonas and were clinically stable, the dose was reduced to 1 g. If pseudomonas was cultured, then the dose remained 2 g. Endpoints included septic deaths, septic events, positive cultures, antibiotic modification, and vancomycin and imipenem usage.
RESULTS: In the first 7 months, 172 patients were treated (70% neutropenic), 50 with solid tumors and 122 with leukemia or bone marrow transplant. One septic death and 11 septic events occurred. Breakthrough bacteremias on cefepime included one bacteroides, seven coagulase-negative staphylococci, and two enterococci. Antimicrobial additions to cefepime included vancomycin (31%), amphotericin (14%), and aminoglycosides (20%). Compared to prior ceftazidime usage, vancomycin doses were reduced 25% and saved $7000 annually. Imipenem doses were reduced 70% and saved $47,000 annually.
CONCLUSIONS: Compared to a prior history of using ceftazidime, substitution with cefepime with dose reduction decreased vancomycin and imipenem usage and prevented frequent breakthrough GNR bacteremias or septic deaths.

236. Evaluation of a pharmacist-managed emergency department culture follow-up program. *Kevin O. Rynn, Pharm.D.*, Juanice Middleton, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

PURPOSE: Appropriate use of antibiotic therapy is an established role of pharmacists in various environments. The emergency department (ED) offers a unique opportunity to provide care for patients presenting with infectious diseases. The purpose of this evaluation is to document the value of pharmacy services to patients discharged from the ED with infectious complications.
METHODS: This was a 4-month prospective analysis of a pharmacist-managed culture follow-up program in an urban ED. Baseline data obtained included age, gender, culture type, and initial empiric treatment. Patients were contacted to evaluate outcome and need for pharmacist intervention. Outcome was classified into five categories: compliance teaching needed, empiric antibiotic therapy not given, change in antibiotic therapy required, no intervention necessary, and lost to follow up. Follow up was provided by the pharmacist when indicated.
RESULTS: Ninety-seven patients were evaluated with 100 positive cultures. Cultures included 47 urine, 20 blood, 11 wound, 7 urethral/cervical, 5 monospots, and 10 other. Average patient age was 56.5 ± 9.2 years, 50 were female. Four patients were noncompliant and were counseled on medication use. Eight did not receive antibiotics upon discharge, while seven required a change in therapy; for these groups the primary physician was notified, the patient had a new prescription initiated by the pharmacist, or patients were asked to return. Seventy-one patients were treated appropriately requiring no intervention. Seven patients were lost to follow up.
CONCLUSION: The majority of patients were treated appropriately. Nineteen patients required follow up to assure positive outcome allowing pharmacists the opportunity to impact ED patient care.

237. The clinical and economic impact of a pharmacist-managed antimicrobial restriction program at a university hospital. *Heather L. VandenBussche, Pharm.D.*, Randolph E. Regal, Pharm.D.; University of Michigan Health System, Ann Arbor, MI.

PURPOSE: This study evaluated the clinical and economic impact of a pharmacist-managed antimicrobial restriction program at a university hospital one year post-implementation.
METHODS: In September 1997, in response to high antimicrobial expenditures and increasing bacterial resistance related to inappropriate use of antimicrobials, this university-based teaching hospital implemented an inpatient antimicrobial restriction program. Fourteen antimicrobial agents were restricted to specific criteria developed by pharmacy and infectious disease physicians. Two clinical pharmacists provided daily services to ensure that restricted antimicrobials were being prescribed according to restriction criteria. When antimicrobials were used outside of the pre-approved criteria, alternative therapy was recommended by the clinical pharmacists, or usage was approved by infectious diseases. Antimicrobial expenditures were tracked monthly and susceptibility patterns were observed for changes.
RESULTS: Compared to the previous year, the restriction program's first year resulted in a 12% savings of $277,000 for all antimicrobials. The cost per patient-day for restricted antibacterials was reduced from $7.66 to $5.81; restricted antifungal costs were reduced from $3.34 per patient-day to $3.20. However, *Pseudomonas aeruginosa* resistance to ciprofloxacin increased from 10% to 19% during this time, resulting in a more comprehensive restriction of all fluoroquinolones. There is an anticipated delay of 1-2 years before a significant change in susceptibility patterns can be realized.
CONCLUSION: The restriction program resulted in significant cost savings after one year of operation. Susceptibility patterns will be continually monitored to assess the effectiveness of the program on local microbial flora.

238. Utilization of a real-time, computerized, clinical database to optimize inpatient pharmaceutical care: focus on antimicrobial cost savings. Angela M. Wisniewski, Pharm.D., *Patrick F. Smith, Pharm.D.*, James D. Scott, Pharm.D., Mary C. Birmingham, Pharm.D., Martin H. Adelman, Ph.D., Jerome J. Schentag, Pharm.D.; Millard Fillmore Health System; The State University of New York at Buffalo, Buffalo, NY.

PURPOSE: The Clinical Pharmacokinetics Laboratory at Millard Fillmore Health System (600-bed teaching hospital) utilizes a unique method of antimicrobial management. The purpose of this study was to report our experience with this approach.
METHODS: In 1993, the clinical pharmacokinetics laboratory implemented a real-time, computerized database linking admissions, pharmacy,

microbiology, and laboratory data. Clinical services (approximately 1.5 full-time equivalents) include intensive care unit, general medicine, pharmacokinetic consults, and a computerized, targeted intervention program. The computerized intervention program allows rapid, efficient screening of patients likely needing clinical intervention. Each patient is assessed for antibiotic choice, culture/sensitivity results, pharmacokinetic/dynamic dose optimization, therapy duration, oral switch, toxicity, and eligibility for clinical study participation. The cost incurred or avoided for each intervention was documented, based upon hospital drug and administration costs. Cost savings from January 1993 to December 1997 were tabulated, with all results corrected for inflation (3%/year).
RESULTS: During the study period, a gross cost-avoidance of approximately $1.6 million in antimicrobial drug and administrative costs was realized.

Intervention	Total Number	Total Saved	Saved/Year	Saved/ Intervention	Outcome (% Satisfactory)
Dose change	5584	$455,351.53	$91,070.31	$81.54	81.8
D/C antibiotics	2681	$541,901.21	$108,380.24	$202.13	87.7
IV regimen	1660	$311,118.22	$62,223.64	$187.42	82.0
Switch to oral	1029	$266,735.02	$53,347.00	$259.22	96.0
Other	147	$27,546.62	$5509.32	$187.39	63.6
Totals	11,101	$1,602,652.61	$320,530.52	$183.54 (mean)	82.2 (mean)

CONCLUSIONS: During the study period, a significant cost savings was realized, while achieving satisfactory patient outcomes. Access to real-time patient data significantly increases the efficiency of providing pharmaceutical care.

239. Impact of a pharmacist-run aminoglycoside once-daily dosing program in a tertiary teaching institution. Emily W. Kao, M.S., *Alexandra L. Stirling, Pharm.D.*, J. Andrew Skirvin, Pharm.D., Bruce Hirsch, M.D.; North Shore University Hospital; St. John's University, Jamaica, NY.

PURPOSE: Staff pharmacist-directed implementation of an aminoglycoside once-daily dosing program.
METHOD: A gentamicin/tobramycin dosing nomogram based on creatinine clearance (CrCl) and eligibility criteria was developed with physician and pharmacist input. Dosing was recommended at 5 mg/kg/day for CrCl > 100 ml/min, 4 mg/kg/day for CrCl 80-99 ml/min, 3.25 mg/kg/day for CrCl 50-79 ml/min, 2.5 mg/kg/day for 30-49 ml/min, and 2 mg/kg/day for CrCl < 30 ml/min. Pharmacists, physicians, and nurses were informed of the program. Pharmacists performed subsequent prospective evaluation and monitoring of all aminoglycoside orders since the program was instituted in January 1997.
RESULTS: There were 1433 aminoglycoside orders reviewed in 1997. Use of once-daily dosing of aminoglycosides increased from 47.8% for the initial 6-month period after program implementation, to 60.9% for the final 6 months of 1997 ($p<0.05$). Data from 630 orders reviewed during 7 months in 1998 reveal 61.1% once-daily aminoglycoside dosing. Our suspected drug reaction reporting program reveals that the incidence of aminoglycoside-related toxicity in 1997 was unchanged at 1.8% when compared to 1996. Suspected drug reaction data for 1998, as well as the impact of this program on the number of aminoglycoside levels ordered, is currently being examined.
CONCLUSION: The implementation of an aminoglycoside once-daily program that involves staff pharmacists has been a successful integration of physician and pharmacist interaction based on patient eligibility for once-daily dosing. The initial implementation has showed an increase in the percentage of patients receiving once-daily dosing without increased incidence of adverse effects noted. Persistent educational efforts are required to maintain continued success of similar programs.

240. Therapeutic outcomes from a pharmacy-managed aminoglycoside pharmacokinetic consult service. *Mitchell Nazario, Pharm.D.*, Leah David-Hoke, Pharm.D.; San Juan VA Medical Center, San Juan, Puerto Rico.

PURPOSE: To evaluate the impact of a pharmacy-managed pharmacokinetic consult service (PKCS) on aminoglycoside dosing, monitoring, and patient outcomes at the San Juan VA Medical Center.
METHODS: All patients from a medical service ward that were prescribed aminoglycosides participated in the study under the care of the PKCS. PKCS pharmacists were responsible for all aminoglycoside dosing and monitoring. The control group were patients prescribed aminoglycosides in another medical service ward.
RESULTS: One hundred twenty-four patients were followed by the PKCS in the study group. In the control group, 55 patients received aminoglycosides. Thirty patients were randomly selected from both groups for a preliminary evaluation. Both groups were comparable with respect to patient demographics, length of aminoglycoside therapy, initial serum creatinine, and infection type ($p>0.05$). All patients under the care of the PKCS had aminoglycoside serum levels drawn and dosage adjustments as needed. In contrast, 36.7% of patients in the control group did not have any aminoglycoside levels. In addition, no dosage adjustments were made in some patients with unstable renal function (46.7%) or inadequate serum levels (40%). Fever and leukocytosis resolved more rapidly in the PKCS followed group ($p<0.05$). A trend toward fewer adverse drug events was observed in the PKCS-followed group.
CONCLUSIONS: The pharmacy-managed PKCS improved patient outcomes through more accurate dosing, 100% ordering and monitoring of aminoglycoside levels, 100% dosage adjustments for changes in renal function and inadequate levels, more rapid resolution of fever and leukocytosis, and possible reduced incidence of adverse drug events.

Managed Care

241. Pharmacist-managed hypertension in a group model managed care setting. *Caroline E. Kicklighter, Pharm.D., BCPS*, Kent M. Nelson, Pharm.D., BCPS, Jennifer A. Pratt, M.D.; Kaiser Permanente, Lakewood, CO.

PURPOSE: This study compared hypertension patient management by a clinical pharmacy specialist (CPS) to routine medical care.
METHODS: This 6-month prospective, parallel study compared the therapeutic management of uncontrolled adult hypertensive patients by a CPS to a group of physicians. Study patients were referred by their physician to the CPS for hypertension management if they had an appointment between October 21 and December 1, 1996. The CPS directly managed the study group with physician approval. Medications were chosen based on JNC-V guidelines. Study patients were encouraged to use home blood pressure monitoring. Adult hypertensive patients at another Kaiser Permanente facility with appointments during the study period served as the control group and were managed by a group of physicians.
RESULTS: The study group and control group each consisted of 113 patients. One study patient left the health plan and was excluded. Blood pressure control was achieved in 67% of study patients compared to 31% of control patients. Two control patients experienced fatal cardiovascular events. There were no deaths in the study group. β-blockers and diuretics comprised 64.3% of hypertension medications in the study group and 53% in the control group. Home blood pressure monitoring was used by 49% of the study patients and 1% of the control patients. The overall number of phone calls and office visits increased in the study group.
CONCLUSIONS: The CPS improved blood pressure control and increased the use of drugs proven to reduce morbidity and mortality. Enhanced hypertension patient management with a CPS will result in improved patient outcomes.

242. Impact of an educational intervention on the use of angiotensin converting enzyme inhibitor therapy for congestive heart failure in an independent practice association managed care setting. *Lauren H. Hoffman, Pharm.D.*, Michael L. Latimer, CPA; Blue Cross and Blue Shield of Florida, Jacksonville, FL.

PURPOSE: The impact of a drug utilization evaluation educational intervention program on increasing compliance with angiotensin converting enzyme inhibitor (ACEI) prescribing guidelines in an independent practice association managed care setting was studied.
METHODS: Medical and pharmacy claims were reviewed to identify congestive heart failure (CHF) patients not receiving therapy with an ACEI. Four thousand four hundred fifty patients were identified with CHF; 55% were not receiving treatment with an ACEI. Educational letters were mailed to 1195 physicians; responses were requested. Responses to the intervention were monitored. Increases in number of prescriptions for ACEI and medical claim costs for CHF were monitored and compared to a control group from 12 months previous in whom no intervention was performed.
RESULTS: Analysis at 6 months showed significant increases in ACEI claims for the study group compared to the control. Intervention costs and percentage of patients who meet guidelines will be compared to determine the cost effectiveness of the intervention on achieving compliance with guidelines. Medical claim cost differences will also be tracked to determine the overall economic outcome of ACEI therapy.
CONCLUSION: A drug utilization evaluation physician educational intervention is a cost effective approach to positively impact patient pharmacotherapy in an independent practice association managed care setting.

243. Reporting that influences physician prescribing in a managed care environment. *Martha J. Erickson, B.S.*, Debora K. Hillmann, Richard J Zunker, Pharm.D.; Prime Therapeutics Inc., St. Paul, MN.

PURPOSE: To develop clinical education programs with reporting tools designed to influence physician prescribing patterns and realize cost savings for managed care organizations (MCOs).
METHODS: Pharmacy benefit managers (PBMs) take a stepwise approach to identify therapeutic drug classes for building clinical education programs. The process includes the following steps: 1) clinical pharmacists review drug utilization data to target potential program feasibility, effectiveness, and cost savings; 2) findings are presented to the MCO for approval; 3) PBM pharmacists conduct literature review of all drugs in a therapeutic class, typically identifying a preferred agent at the conclusion; 4) the PBM builds contractual relationships with manufacturers based on market share shift projections of preferred agents; 5) PBM analysts develop clinic- and physician-specific reporting tools; 6) PBM introduces preliminary

presentation for physician peer review to encourage recommendations and validate medical community acceptance; 7) the program is presented to the MCO Pharmacy and Therapeutics Committee for final review and approval; and 8) PBM pharmacists present education programs, with detailed therapeutic class reports at clinics throughout the state.
RESULTS: Presentation of detailed physician and clinic prescribing reports combined with education programs has resulted in a plan savings for Blue Cross Blue Shield of Minnesota in the angiotensin converting enzyme inhibitor strategy of $5.2 million over a 31-month time period.
CONCLUSION: Clinic education and reporting programs have proven effective in controlling drug spend in MCOs.

244. Physician attitudes regarding varying degrees of clinical pharmacy involvement in managed care primary care clinics. *Jacquelyn S. Hunt, Pharm.D.*, John L. Woon, Pharm.D.; Providence Health System, Portland, OR; Pfizer Inc., Vancouver, WA.

PURPOSE: To determine the opinion of physicians regarding varying degrees of clinical pharmacy involvement prior to institution of pharmacotherapy clinics.
METHODS: The survey was constructed to determine physician perception of clinical pharmacy involvement in patient care and the value of clinical pharmacy services to a primary care practice. A 5-point Likert scale design was chosen to assess attitudes. The survey instrument was reviewed for face validity and piloted by a sample group of physicians. The statements were worded to avoid response-set bias. Questionnaires were distributed at a physician seminar attended by 39 of 65 Portland-based primary care physicians.
RESULTS: Data collected from physicians established a baseline of physician acceptance of clinical pharmacy involvement. Most physicians agreed with clinical pharmacists providing traditional services, such as drug information (95%), patient education (82%), and drug interaction screening (95%). However, a large percentage of physicians were opposed to clinical pharmacists designing drug regimens (53%), ordering labs (58%), initiating medications under physician-approved guidelines (41%), or conducting a limited physical exam (38%). Only 29% of physicians reported they were familiar with how clinical pharmacists are trained.
CONCLUSION: Based on these results, approximately half of the physicians surveyed indicated reluctance to accept a more collaborative role of clinical pharmacy. Targeted educational interventions focusing on abilities of advanced clinical pharmacy were conducted prior to opening pharmacotherapy clinics. Our hypothesis is that by increasing exposure to collaborative opportunities, physicians will alter their opinion. We plan to re-survey physicians one year after the pharmacotherapy clinics open.

Nephrology

245. Involvement of a pharmacist in an outpatient hemodialysis clinic. *Jatinder S. Harchowal, B.Pharm., M.S., M.R.Pharm.S.*, Robert Hirst, B.Pharm., M.R.Pharm.S., Sally Punter, B.Pharm.; King's College Hospital, London, United Kingdom.

PURPOSE: Risk factors to drug-related admissions include multiple drug therapies and patients' poor understanding about their medication. A previous investigation by the author showed an incidence of 47% drug-related admissions (DRAs) to a renal unit. The following factors were identified as possible causes for DRAs: number of medications taken by a patient and incomplete information on medication available to the patient. Recommendations made from the study included the need for multiple medication regimens to be constantly reviewed and simplified for patients and to involve a pharmacist in outpatient clinics to help review medication.
METHODS: A weekly clinic was set up to review all hemodialysis patients. The clinic was comprised of a renal pharmacist and consultant nephrologist. The aims of the clinic were to review and explain medication, discontinue unnecessary medication, and simplify dosage regimens. The savings made through the medication review clinic were also calculated.
RESULTS: Sixty patients were seen in this clinic. The mean number of drugs taken by patients before the clinic was started was 7; this number decreased to 4.5 following review in the clinic. In addition, drug expenditures were reduced by $2500 per month for these patients.
CONCLUSIONS: The numbers of drugs taken were reduced and medications simplified with no adverse clinical events occurring. Problems with adherence were identified through the clinic and corrective action taken (e.g., with phosphate binders, erythropoietin). Significant cost savings were made. The role of the pharmacist as part of a team approach to reviewing medications in hemodialysis outpatients is now established within the Trust.

246. Documentation of pharmaceutical care activities in an outpatient hemodialysis unit. *Edward F. Foote, Pharm.D.*, Omaira Melendez, Pharm.D., Michelle L. Heyman, Pharm.D., Naomi V. Dahl, Pharm.D.; Rutgers, The State University of New Jersey, Piscataway, NJ; UMDNJ-Robert Wood Johnson Medical School, New Brunswick; DCI/RWJ Dialysis Center, North Brunswick, NJ; The Robert Wood Johnson University Hospital, New Brunswick, NJ.

Hemodialysis (HD) patients have complex medication problems which lend themselves to clinical pharmacy intervention. We describe the development of the pharmacy clinic at the Dialysis Clinic Inc.–RWJ Dialysis Unit in North Brunswick, NJ. The clinic was initiated by a college of pharmacy faculty members (EFF) in 1994 under a grant from the ASHP Foundation. In 1996, the program was expanded with the addition of a renal pharmacy fellow (NVD). Currently, pharmacy care is provided by two faculty-pharmacists (EFF and NVD), a renal pharmacy fellow, and an ASHP hospital resident. Baccalaureate and Pharm.D. students participate in the service during their clinical rotations. Salary support is provided by the college of pharmacy, the medical school (NVD), the dialysis unit, and the hospital.
The pharmacy clinic cares for approximately 100 HD patients on the first and second shift who are seen quarterly on a rotating basis. Patients bring their medications to the unit to meet the pharmacist during their dialysis session. The pharmacist reviews the patient record and labs prior to the visit. The pharmacist is responsible for assessing all areas of pharmacotherapy (compliance, adverse events, appropriateness of regimen, etc). Documentation of interventions and recommendations are made in the patient chart and also faxed to the attending nephrologist. Other patients (peritoneal dialysis and evening patients) are seen on a consult basis. Data collection on patient outcomes is ongoing and will be presented.
Future plans, which will necessitate increased funding from the dialysis unit, include expanding the service to third shift patients and seeing patients more frequently.

247. Demonstrating the value of the pharmacist using a systematic evaluative approach for monitoring patients on dialysis. *Janet E. Martin, Pharm.D.*, Andrew Eagleson, B.S., Chau Diep, B.S., Annie Lee, B.S.; London Health Sciences Centre, London; Hotel Dieu Grace Hospital, Windsor; St. Joseph's Hospital, Hamilton, ON, Canada.

PURPOSE: This pilot study was designed to 1) estimate the impact of pharmacists using a systematic evaluative approach to monitoring pharmacotherapy (SEAM) on dialysis patient outcomes and medication costs; and thereby 2) to establish the value of the pharmacist on the dialysis patient care team.
METHODS: This was a 4-week prospective, multicenter, nonrandomized pilot study. All dialysis patients were eligible for inclusion. Standardized assessment tools (SEAM modules) for selected disease states were developed to facilitate screening for drug-related problems (DRPs). All DRPs identified were recorded, and recommendations to solve or prevent the DRPs were made. Impact on patient outcomes was estimated by assigning each DRP a severity score based on a previously published scale.
RESULTS: Four study pharmacists contributed a total of 42 hours toward the assessment and review of 51 patients. A total of 101 DRPs were identified for a rate of 2.4 DRPs identified per hour. At study completion, 84% of the pharmacists recommendations had been accepted, and 10% were still pending. Seventy-seven percent of recommendations made were ranked as likely to have a very significant or significant impact on patient outcomes. Pharmacist involvement in patient care resulted in an average estimated savings in medication cost of $32.50 per patient per month.
CONCLUSIONS: Pharmacists using SEAM had a positive estimated impact on patient outcomes and medication costs, thereby demonstrating value-added service to dialysis patients under the care of a multidisciplinary team.

248. Pharmaceutical care in a university medical center-affiliated ambulatory dialysis center. *Gary R. Matzke, Pharm.D., FCP, FCCP*, Alicia C.M. Alexander Cadogan, Pharm.D., John J. Kim, Raymond M. Rault, M.D.; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: Pharmacotherapy is essential to compensate for several of the metabolic and hormonal disturbances resulting from endstage renal disease (ESRD). The addition of a pharmacist to the multidisciplinary patient care team may improve patient outcomes due to the complexity of drug regimens, costs, and regimen individualization needs of dialysis patients. This report describes the impact of pharmaceutical care service provision to a university medical center-affiliated ambulatory dialysis center.
METHODS: The justification, implementation, and outcomes associated with the provision of pharmaceutical care to hemodialysis patients are described. Therapeutic outcome measures including adequacy of iron stores, appropriateness of erythropoietin dosage, and proportion of patients with hematocrits in target range were recorded over a 4-year span (1994-1997). The economic impact on two target medications, erythropoietin and calcitriol, were also assessed.
RESULTS: Iron stores were sufficiently maintained in 69.2% of pharmaceutical care patients versus 47.8% of control subjects. Adjustments of erythropoietin dosage were appropriate in 91% of pharmaceutical care versus 25% of control subjects. During the observation period, the average hematocrit rose from 30.8% in 1994 to 34.0% in 1997. While 51% of patients had hematocrits less than 30% prior to service implementation, by 1997 less than 10% of patients had values below 30%. Although erythropoietin and calcitriol use increased during the period, a consistent economic benefit of the pharmaceutical care services was evident, which ranged from $61,150 to $78,960 per year.

CONCLUSIONS: The addition of pharmaceutical care to the ESRD patients' care team resulted in significant and persistent improvements in clinical and economic outcomes.

Neurology

249. Safety and effectiveness of a pharmacy-based dose recommendation service for phenytoin in hospitalized adult patients. *Stefan F. Muehlebach, Ph.D.*, Ursula Schmid, Enea F. Martinelli, Ph.D.; Dantonsspital Aarau, Aarau, Switzerland; Regionalspital Interlaken, Interlaken, Switzerland.

PURPOSE: Phenytoin, a mainstay in the treatment and prevention of epilepsy, shows a small therapeutic index characterized by nonlinear pharmacokinetics and a wide interindividual variation. With respect to drug safety, a standardized dosage regimen efficient to reach and maintain recommended serum target levels of 40-80 mM is of high clinical value for initial rapid loading and long-term phenytoin treatment.
METHODS: In a 600-bed teaching general hospital, over a 21-month period, all phenytoin therapeutic drug monitoring serum levels were recorded and correlated to the adherence of a recommended, clinically validated, dosage guideline: initial 15 mg/kg body weight IV bolus over 4 hours, followed by 175 mg BID IV bolus over 15 minutes (202 mg for those weighing more than 70 kg) up to day 5, and a subsequent dose individualization with Bayesian forecasting with 1-3 serum levels (PHENDOSE). Dose recommendations were provided by the pharmacy.
RESULTS:

	PHENDOSE	Other
Patients (n)	70	424
Serum Samples (n)	257	649
Phenytoin (µM)*	47.3 ± 17.0 (45.3)	41.6 ± 25.0 (35.5)
Concentrations (%)		
< 10 µM	3.5	12.3
< 40 µM (< 30 µM)	35.4 (16.0)	63.5 (47.6)
40-80 µM	59.5	29.0
> 80 µM	4.7	7.6
> 100 µM	0.4	2.8
Maximum Conc (µM)	107	156

*Mean ± SD (median)

CONCLUSIONS: In an unselected group of hospital patients, the use of an IV phenytoin dosage regimen standardized over days 1-5 and subsequently individualized by pharmacy recommended dosages using Bayesian forecasting provided significantly better therapeutic serum levels compared to other currently used dosage guidelines.

250. Neurosurgery clinical pharmacy discharge program. *Deepa Setty, Pharm.D.*; University of California San Francisco Medical Center, San Francisco, CA.

PURPOSE: The clinical pharmacists at the University of California San Francisco have implemented a continuity of care program that oversees neurosurgery patients prior to surgery in clinic, during hospitalization, and post-discharge. To ensure that patients attain their medications properly, all patients discharged to home will be called within 72 hours of discharge by the clinical pharmacists, pharmacy residents, or students.
METHODS: All patients discharged from this service will have their medications called into their pharmacy of choice, counseled by a pharmacist or pharmacy student, and are given medication schedules and steroid tapers. Patients are also given a neurosurgery clinical pharmacy office number for questions or concerns regarding their medications. A voice mail message provides an on-call pharmacist pager number for medication-related emergencies. All patients discharged will be telephoned at home within 72 hours to ensure medications were properly attained, are taken correctly, and to assess that major issues in the inpatient setting are resolved. All telephone callbacks and interventions are logged and kept for records.
RESULTS: From January to September of 1998, 625 neurosurgery patients have been discharged to home from the service and called at home. The clinical pharmacists, pharmacy residents, and students have made 162 interventions out of the 625 patients (26%) by utilizing this callback program.
CONCLUSIONS: Discharge planning and post-discharge telephone calls by clinical pharmacists will
potentially reduce medication errors, increase patient satisfaction, improve patient outcomes, and transition the patient from the inpatient to outpatient setting with continuity of pharmaceutical care.

251. Implementation of a headache educational and management program by a community pharmaceutical care resident in two community pharmacies. *Carrie A. Foust, Pharm.D.*, Marla R. Tonn, B.S., Alan M. Shepley, B.S., Jay D. Currie, Pharm.D.; University of Iowa, Iowa City, IA; Liberty Pharmacy, North Liberty, IA; Shepley Pharmacy, Mt. Vernon, IA.

PURPOSE: Being accessible and the most trusted health care professional, the community pharmacist encounters patients in search of counsel and treatment for headache. This headache management program was designed to educate pharmacists to become an integral part of the headache health care team through the provision of education and monitoring. The program seeks to show the beneficial effects of pharmacist active involvement in the management of patient's headache therapy utilizing selected evaluation strategies.
METHODS: The headache management program implementation consists of multiple stages including: 1) development and collection of educational materials and tools, 2) education of pharmacists and staff, 3) establishment of a referral system with area health care providers, 4) development of marketing and reimbursement strategies, 5) provision of the program to headache patients, and 6) documentation of results. The complete program consists of four in-pharmacy visits and four follow-up calls, which may be individualized based on patient needs.
RESULTS: Outcome measures include: 1) change in emergency department visits/hospitalizations, 2) change in headache number/frequency/severity/duration, 3) degree of debilitation assessed through number of work or school days missed, 4) patient satisfaction with services, and 5) quality of life (SF-12). Preliminary data will be available for presentation in April 1999.
CONCLUSIONS: Program results will show the impact a pharmacist-driven headache management program can have on headache patients. Pharmacists can be key players in the identification of headache patients, provide education and medication management, and coordinate the directing of these patients back into the health care system.

252. Expanding services in a pharmacist-managed stroke-antithrombosis clinic to include hyperlipidemia management. *Allen K.L. Shek, Pharm.D.*, Edith Nutescu, Pharm.D., Nancy Shapiro, Pharm.D., Julie Volkman, Pharm.D. candidate, Richard K. Lewis, Pharm.D., MBA, Cathy Helgason, M.D.; University of Illinois at Chicago, Chicago, IL.

PURPOSE: A high percentage of patients followed in our pharmacy-managed stroke-antithrombosis clinic (SATC) have multiple risk factors, including hypercholesterolemia. To provide a comprehensive risk factor reduction program, we expanded our services to include lipid management. The purpose of this study is to assess the feasibility and the impact of this newly expanded service.
METHODS: Pharmacotherapists providing patient management have collaborative prescribing privileges under SATC protocol. Pharmacotherapists' responsibilities include patient evaluation and education on risk factor reduction, medication selection and adjustment, individualized dietary counseling, and therapeutic monitoring. Follow-up visits and lipid profiles are obtained every 4 to 12 weeks depending on clinical status. Treatment protocols are based on the NCEP II guidelines.
RESULTS: A total of 150 patients have been referred to date. Preliminary data is available for 24 patients. All patients had a goal LDL less than 100. Nineteen patients (79%) met goal LDL in an average of 24.5 weeks. Average baseline lipid values include TC 212, TG 206, HDL 43, and LDL 135. After 3, 6, and 9 months, TC decreased to an average of 170, 176, and 167, respectively ($p<0.05$ at 3, 6, and 9 months). LDL decreased to an average of 99, 102, and 95, respectively ($p<0.05$ at 3, 6, and 9 months). There were no statistically significant changes in TG and HDL.
CONCLUSION: This model of expanding services in the SATC to include hyperlipidemia management has been successfully implemented. Preliminary results indicate that pharmacists can have a significant impact on the lipid management of stroke patients.

253. A 5-year retrospective and descriptive evaluation of the value of clinical pharmacists in a neurosurgery spasticity clinic using an intrathecal drug delivery device (Medtronic Syncromed™ pump). *Michael G. O'Neil, Pharm.D.*, Marc Lapointe, Pharm.D., BCPS, Brian Cuddy, M.D.; Charleston Area Medical Center; Medical University of South Carolina, Charleston, SC.

PURPOSE: Debilitating spasticity can result from multiple processes including spinal cord injury, multiple sclerosis, cerebral palsy, and stroke. Oral medications are the first line treatment for severe spasticity. Pharmacologic management is often not effective and intolerable side effects may occur. Surgical implantation of a programmable pump allows delivery of the antispastic agent baclofen intrathecally. The spasticity clinic at the Medical University of South Carolina is the only one in North America coordinated by a clinical pharmacist. This abstract describes the pharmacist's role, justification of pharmacy services, and clinical activities.
METHODS: The clinical pharmacist is responsible for the initial patient screening for intrathecal pump placement which includes physical examination, spasticity scoring, and determining therapeutic goals. Administration of an intrathecal baclofen test dose is performed by a neurosurgeon. Evaluation of response to the test dose and monitoring for adverse effects is performed by the clinical pharmacist. Intra-operatively, the pump is prepared and programmed by the clinical pharmacist. Evaluation of spasticity and pump refills are completed by the clinical pharmacist at each clinic visit. The clinical pharmacist remains on call for emergencies.
RESULTS: Details related to procedures, visits, and outcome over the last five years are presented: 1) it takes a short time for patients to reach goals, 2) there is a decreased length of stay in clinic for patients, 3) unnecessary

admissions are prevented, 4) there is increased patient education and compliance, and 5) the neurosurgeon must be present only for confirmation of therapeutic plans.
CONCLUSIONS: Clinical pharmacists can play a key role in a neurosurgery spasticity clinic. Specifically, therapeutic goals are achieved consistently, adverse effects may be minimized, and quality of life may be improved.

Nutrition

254. Enteral nutrition and concomitant drug therapy: drug-diet interactions monitoring. *L. Poggi*, L. Giuliani, A. Pisterna, F. D'Andrea; Azienda Ospedaliera Maggiore Della Carita, Novara, Italy.

PURPOSE: The free home supply of enteral nutrition (EN) products (Novara County since 1993) allowed the saving of hospitalization days and improved the quality of life. Enteral routes (PEG/DS) are also used for drug administration; this represents a risk of incompatibility and drug-diet interactions.
METHODS: Each patient or family member was interviewed by a hospital pharmacist about prescribed therapy and administration procedures. The therapy was evaluated to detect potential drug-drug or drug-nutrient interactions. When therapeutic drug monitoring (IMXr™, Abbott) was possible (anticonvulsants, digoxin, theophylline), periodic controls were performed, otherwise bibliographical sources were used for information. In the case of widely used drugs, parameters showing the achievement of therapeutic targets were investigated. In vitro tests simulating stomach and jejunum pH conditions were performed to complete the research about potential drug-nutrient interactions. At the present time, trials about some commonly used molecules are going on.
RESULTS: Four hundred forty-eight patients were monitored: 266 oncologic, 158 neurologic, and 24 others. Forty-two neurologic patients received a long-term treatment with anticonvulsants. After the beginning of EN, almost all patients required drug dosage and nutritional schedule adjustments to reach the therapeutic range. The antihypertensive and neurologic drugs under investigation are amlodipine, enalapril, sotalol, fosinopril, lorazepam, and fluoxetine. First available data concerning antibiotics and analgesic agents do not indicate clinically significant interactions with the assessed enteral formulas.
CONCLUSIONS: The findings of this study indicate that nutrient-medication interactions can affect the quality and the cost effectiveness of health care. A cooperative team approach is therefore essential to provide optimal hospital and home care.

255. Evaluation of the outcome of pharmaceutical care provided to clinical nutrition patients. *Jennifer Cerulli, Pharm.D., BCPS*, Margaret Malone, Ph.D., FCCP, BCNSP; Albany College of Pharmacy, Albany, NY.

PURPOSE: To prospectively evaluate and quantify pharmaceutical care activities provided to clinical nutrition patients. Objectives included: 1) document the number and types of interventions made, 2) determine the acceptance rate of the recommendations, and 3) document their impact on patient care.
METHODS: Three hundred fifty-two patients were evaluated during outpatient medication history review and inpatient clinical rounds. Interventions which included drug information requests and identification of drug-related problems (DRP), including patient outcomes, were documented.
RESULTS: Two hundred interventions were made, including 34 drug information requests. One hundred sixty-six DRP were identified in 122 (35%) patients. The most frequent DRP were drug interaction (32/166), inappropriate drug administration (23/166), untreated indication (21/166), and improper drug selection (13/166). Of 166 recommendations, 127 were accepted, 18 were accepted with a modification, 13 were not accepted, and the outcome of 8 was unknown. One hundred twenty-five of the 145 recommendations that were accepted or accepted with a modification had a positive outcome; 42 patients showed improvement and 83 patients developed no complications. Six patients did not respond to the recommendation made and in 14 patients the outcome was unknown. Fifty-five recommendations avoided potential adverse drug events. Of all recommendations, 51 involved a reduction in drug costs and 36 involved increased drug costs. Pharmacist time spent was estimated at 10 minutes per DRP intervention. The most frequent interventions involved gastrointestinal drugs (n=41), antiinfectives (n=34), nutritional supplements (n=30), and nutrition support (n=27).
CONCLUSIONS: Pharmacist interventions identified DRP in one-third of clinical nutrition patients and had a positive impact on patient care.

Oncology

256. An information system to organize centralized preparation of cytotoxic medication. *Pascal Assicot*, Christophe Pitré, Gilles Piriou, David Feldman, Raymond Saout, Michèle Milochau; Morlaix Hospital; Cavale Blanche Hospital, Finistère, France.

PURPOSE: As part of the quality assurance of centralized preparations of cytostatic medications in our pharmacy department, it seemed relevant to develop a computer application designed to manage formulation process and work around isolator areas.
METHODS: The software is written using Microsoft Access™ on Microsoft Windows™ compatible with a PC network. It is built as a hierarchical database including tables (products, containers, diluents, patients, prescribers, pharmaceutical assistants, nursing departments, etc.), SQL queries allowing data analysis, forms for data acquisition, and printing reports. For security and license reasons we use a runtime application. The software is ergonomically designed for good handling. Daily saves are done on the establishment net.
RESULTS: This program has been in use since June 1996 with trouble-free operation. One hundred one protocols are registered and 4119 formulations were treated. In order to have rigorous control over the overall process flow of the chemotherapy cycle, many reports can be printed. This software allows: 1) streamlining of the pharmacist's work (maintenance, sterilizations, formulation process, and human resource assignments); 2) improvement of the cytostatic (orders, stock, out of dates, etc.) and associated medications (anti-emetics and hematopoietic growth factors) management; 3) anticipation of financing and following therapeutic innovations in oncology; and 4) improvement of pharmaceutical quality control.
CONCLUSIONS: An extension of our software to support chemotherapy orders will be the next logical step. This could supply on-screen access to pertinent and consensual information on antineoplastic drug therapy. At last, such a system would allow the standardization and rationalization of medical practices in our hospital.

257. Clinical outcomes associated with pharmacist-initiated changes in drug therapy and patient management. *Jo-anne E. Brien, Pharm.D.*, Danielle N. McLennan, B.Pharm., Michael J. Dooley, B.Pharm.; Monash University, Parkville; Peter MacCallum Cancer Institute, East Melbourne, Victoria, Australia.

PURPOSE: To determine actual patient outcomes of pharmacist-initiated changes in drug therapy or patient management and to identify the clinical activities which generate these interventions.
METHODS: The Society of Hospital Pharmacists of Australia intervention definition was adopted for this study. Pharmacists interventions associated with inpatient care were collected over a 2-month period (June-July 1998, inclusive) at Peter MacCallum Cancer Institute, an oncology tertiary referral center in Melbourne, Australia. Patients were assessed prospectively by an independent research pharmacist to determine clinical outcomes resulting from pharmacists interventions. Activities and interventions relating to drug formulary and supply were excluded from the study. Activities prompting pharmacists to intervene, reasons for intervening, and predicted outcomes were documented.
RESULTS: Six hundred seventy-four interventions were recorded. Where outcomes were assessed, 90% of interventions resulted in documented clinical benefit. The activities which most frequently prompted pharmacist to intervene were medication history interview (55%), clinical review (27%), and medication history interview (11%). Data analysis using chi squared tests demonstrated statistical relationships between the intervention type (reason for intervening) and activity.
CONCLUSION: This prospective study demonstrates the high rate of documented beneficial outcomes achieved by pharmacists interventions into patient management. An appreciation of the types of activities which generate interventions can assist in focusing resources and training into activities which lead to beneficial patient outcomes.

258. Quality improvement processes in an oncology pharmacy service: on the way to ISO 9002 normalization. *Kazine Savelli*, Jean-François Tournamille, Jean-Marie Canonge; University Hospital Burpan, Toulouse, France.

In 1995, a centralized unit of chemotherapy reconstitution was created at the Toulouse University Medical Center. The pharmacist decided to buy an isolator which was a prototype whereby four agents can be handled at the same time. The isolator uses peracetic acid to sterilize the products.
Due to the new Bonnes Pratiques de Fabrication published for pharmaceutical industry by the Ministry of Health in January 1998, and due to the expansion of chemotherapy, a quality assurance system is required. We were helped by the strategy and quality department of the hospital, with our aim to be as near ISO 9002 norms as possible.
The first step was to write processes for each part of the job, from receiving the prescription to supplying chemotherapy to the medical units. Each process was written by the assistant of the pharmacy, discussed with the whole staff, changed until no more remarks were made, and then validated by the pharmacist. The second step was to put these processes in place. It was important that the persons who were in charge should be in position to read the reference documents at any time. The third step (which is still underway) is to write a quality handbook. This handbook will consist of all the processes applied in the unit, including all directions for use and a bibliography.
This approach gives a sense of responsibility to technicians, and increases the

nurses' confidence in the service we provide. Furthermore, patients receive good treatment of the highest quality.

259. A review of clinical pharmacist activities provided for cancer patients. *Peter C. Tenni, M.Pharm.*; Curtin University of Technology, Perth, Australia.

PURPOSE: To analyze patterns of practice and activities with a view to demonstrate the benefits of these services.
METHODS: Data regarding clinical services and interventions were recorded at three hospitals. Information recorded for clinical services included the type of service, the drug on which the service was focused, and the time taken to complete the service. Information recorded for clinical interventions included the drug involved, the clinical service that led to the intervention, the type of intervention, the clinical significance of the intervention, the desired outcome of the intervention, and whether the outcome was achieved.
RESULTS: Four hundred forty-one admissions resulted in 1854 medication chart reviews (MCRs), 1315 routine clinical services (CSs), and 148 interventions. CSs occurred at a rate of 70.9 CSs per 100 MCRs and 3.0 per admission. Common clinical services included biochemistry test reviews (427, 32.5%) and services pertaining to drug information (236, 17.9%). Interventions occurred at a rate of 7.9 interventions per 100 MCRs (0.3 per admission). The clinical significance of the interventions was appreciable or major in 92 (62.2%) of the interventions and minor in 50 of the interventions (33.8%). Common types of interventions were dose changes (68, 45.9%) and cessation of drugs (32, 21.6%). Drug cost savings were $9384 for the project period, equating to approximately $30,000 per full-time pharmacist. In situations where appropriate follow up was possible, the intended outcome of the intervention was achieved (n=38).
CONCLUSION: Oncology/hematology pharmacists provide a high level of clinical pharmacy services that are associated with potential clinical and financial benefits.

260. Pharmacist-managed supportive care in an inpatient adult leukemia/bone marrow transplant service. *Courtney W. Yuen, Pharm.D.*, Kethen W. So, Pharm.D., Kelly M. Rabun, Pharm.D.; University of California San Francisco Medical Center; University of California San Francisco Stanford Health Care, San Francisco, CA.

PURPOSE: The goal of pharmacist-managed supportive care on the adult leukemia and bone marrow transplant service is to optimize delivery of patient care within an interdisciplinary practice and to monitor and reduce treatment-related toxicities.
METHODS: The pharmacists, in conjunction with attending physicians, developed supportive care management guidelines which were approved by the pharmacy and therapeutics committee, committee on interdisciplinary practice, and medical executive board of the medical center. Areas of focus included antiemetics, pain, electrolyte replacements, total parenteral nutrition, and discharge medications. To insure the pharmacists maintained quality of patient care, continuous quality improvement data for surrogate markers were collected before and after implementation of the guidelines. Surrogate markers included nausea/vomiting and pain assessment, abnormal laboratory values, adherence to the medical center's TPN/medication guidelines, time saved medical residents and nurses, and patient satisfaction surveys.
RESULTS: Preliminary results showed that the quality of patient care by the pharmacists was maintained as compared to that provided by the residents. In the area of antiemetics, 79% (50/63) and 78% (68/88) of recommendations led to improvement in nausea and vomiting before and after implementation of guidelines. Abnormal serum electrolyte levels were reduced by 2-4%, and the day to oral electrolyte replacement was increased from 3 to 5 days prior to discharge. The majority of orders were written earlier (87% vs 57%), allowing nursing more line-time flexibility. Time savings were estimated at 2 hours per resident. Other findings will be analyzed and reported.
CONCLUSION: Pharmacists can assume an active role in providing effective and quality supportive care to this patient population.

Pediatrics

261. Feasibility study for pharmacist-directed asthma management in a pediatric practice. *Katherine G. Messer, Pharm.D.*, Michael P. Rivey, M.S.; University of Montana, Missoula, MT.

PURPOSE: A pharmacist-managed asthma program was established in a rural Montana pediatrics practice. The program provided patients and their families asthma education, assessment of asthma severity, means for monitoring symptoms, and evaluation of medication use to improve therapeutic outcome over a 12-month period.
METHODS AND RESULTS: The program was developed during an ambulatory care clerkship. It evolved to a paid pharmacist practice position providing continuity of care within the physician's office for all existing and newly diagnosed asthma patients. A local newspaper article describing the role of the pharmacist in managing and improving care for asthma patients attracted additional patients from outside the practice. An initial office visit provided a detailed asthma-focused medical history and physical examination, allowing assessment at the onset of the program. Patients and a responsible party were provided free peak flow meters with directions for use and recording logs. Patients recorded symptoms, use of medications, and peak flow readings 2-4 times daily. The pharmacist worked two mornings per week and was responsible for scheduling follow ups, typically at 2 weeks post initial visit and then monthly thereafter, although telephone follow ups were made more frequently. Patients (age 4-15 years) and families were asked to evaluate the benefits of the program at 6 months and 12 months, and to comment on the pharmacist's contribution to the overall health of the patient. Patient and pharmacist evaluation data will be presented. Reimbursement for the pharmacist's service was provided by the physician, based on actual time spent with patients.
CONCLUSION: A pharmacist practice in a physician office allows access to patient records, closer interaction with the physician, and time away from a busy pharmacy during which patient and family education can be provided in a timely, satisfactory manner.

262. Effect of a restriction policy on vancomycin use based on CDC criteria in a pediatric teaching hospital. *Karen D. Dominguez, Pharm.D.*, Kelley R. Lee, Pharm.D., Fred F. Barrett, M.D.; LeBonheur Children's Medical Center, Memphis, TN.

PURPOSE: We previously conducted a review comparing our pediatric teaching hospital's vancomycin use to CDC criteria. We found significant inappropriate use which continued despite educational efforts. Due to the lack of benefit from passive efforts, an automatic stop order policy was enacted requiring the infectious diseases service to authorize vancomycin use for greater than 72 hours. After implementing this process, we again conducted a review to determine its impact on vancomycin prescribing.
METHOD: As in the previous review, patient data were collected concurrent with hospitalization in all patients receiving intravenous vancomycin during the second week of 6 consecutive months. A clinical pharmacist reviewed the data for appropriateness of vancomycin use based on the CDC criteria. The results were compared to the previous review.
RESULTS:

	Duration* (days)	Vancomycin (g/1000 patients/days	Improper Users (n [%])
Pre-restriction (n=118)	5.4 ± 4 (1-21)	44	64 (54)**
Post-restriction (n=76)	5.4 ± 6 (1-42)	57	33 (43)**

*mean ± SD (range); **p>0.05

Prior to implementation of the policy, most (38%) inappropriate use was for surgical prophylaxis; after implementation, most inappropriate use (45%) was for empiric treatment.
CONCLUSIONS: The 72-hour stop policy did not decrease inappropriate prescribing, probably because the restriction relates more to continued rather than initial use of vancomycin. Surprisingly, the mean duration of use was not decreased and may be a result of outlying data points. Noteworthy is the shift of inappropriate use primarily from surgical prophylaxis to empiric therapy. A 72-hour stop policy may not have affected vancomycin prescribing.

Pharmacoeconomics

263. Cost analysis of two surgical disease-related groups at the university hospital corporation "Federico II" of Naples. *Gabriella Calabro*, Maria Rosaria Vesta, Nicola Carlomagno, Andrea Renda; University "Federico II", Naples, Italy.

In a university hospital corporation, the central pharmacy's expenses, covering all charges of drugs and medical and surgical devices, place a noteworthy burden on the overall budget of the corporation. Many studies monitoring the costs are carried out to try to control, limit, and rationalize the pharmaceutical expenses.
The aim of our study was to assess the costs of the pharmaceutical supplies required for the two most frequent surgical operations performed at the university hospital "Federico II" of Naples (1400 beds).
From January 1, 1997 to December 31, 1997 the case mix of our hospital reports 102,873 ordinary medical and surgical admissions with a total hospital stay of 803,791 days (average stay = 7.81 days). Among 328 disease-related groups (DRGs) observed, the two most frequent surgeries were 1599 (1.5%) inguinal and femoral hernia repair operations in patients greater than 17 years old (DRG 162) and 1389 (1.35%) cholecystectomies without bile duct exploration (DRG 198).
We assessed the relative costs of these DRGs and carried out a comparison among three different surgical divisions of our hospital, analyzing the overall admissions, the total costs in this period, the average expense for each division, and the costs related to these DRGs.
In the period of our study among the three different surgical divisions, the number of hernia repairs was 230 (average 76.6, range 25-125) with costs that vary from Lire 289,218 to Lire 896,047, while 168 cholecystectomies (56.6, range 23-120) were carried out with costs varying from Lire 676,818 to Lire 1,523,671.

264. Investigation of patient satisfaction with pharmacist consultation in a pharmacist-led anticoagulation clinic. *Elma J. Still, B.Pharm., PG Dip, MRPSGB*, Gail McPherson, M.S., Marie O'Brien, B.S., Robert Horne, M.S., Ph.D., MRPSGB; University of Brighton, Elm Grove, Brighton, United Kingdom; Worthing and Southlands National Health Service Trust Hospitals.

PURPOSE: An important aspect of the delivery of pharmaceutical care is to meet the patients' requirements for information about medicines. This study set out to evaluate patient satisfaction with both the information received and the consultation process adopted by the pharmacist.
METHOD: Patients attending a pharmacist-led anticoagulation clinic were interviewed over a 5-week period. The consultation was assessed on the Indian Health Service communication model and the IDEAL health communication model. Patient satisfaction with information received during the consultation was evaluated using the Satisfaction with Information about Medication Scale. Data were analyzed using Statistical Packages for Social Sciences.
RESULTS: Forty patients were enrolled into the study. Levels of satisfaction with information received on medication ranged from 52-98%. Patients were less satisfied with information on length of treatment and the meaning of the international normalized ratio. During the consultation, patients varied in the method in which they liked information to be provided. Thirty-nine percent of patients preferred to receive information by asking questions, 32% found it hard to ask questions, and 85% of patients wanted to receive written information.
CONCLUSION: Patient consultation needs to be individualized to ensure information is provided in an appropriate and systematic manner. This study has provided information about a training program for pharmacists working in pharmacist led-clinics and will be developed for assessing competence of the pharmacists consultation in the future.

265. Early switch from intravenous to oral acetaminophen during the post-operative period. *C. Ripouteau-Rouxel*, O. Conort, J.P. Lamas, M.D., P. Durieux, M.D., G. Hazebroucq; Hospital Cochin, Paris, France.

PURPOSE: To evaluate the impact of an education intervention on the early switch from intravenous to oral acetaminophen during the post-operative period using cost-identification analysis.
METHODS: This was a before and after study conducted from February 1, 1998 to September 30, 1998 in Hospital Cochin, Paris, France. An evaluation was led in two clinical units: 1) anesthetists and nurses from the orthopedic unit attended the education intervention; and 2) the urologic unit was used as a control group. Audits were led before and at 1, 2, and 5 months after the intervention. All patients present in the orthopedic and urologic units during the audits who were treated with propacetamol were included. Data analysis included: the average of inadequate injections of propacetamol per patient; and direct and indirect intervention costs (intangible costs were not included). Injection was considered inappropriate when patients were starting to eat again or taking other PO medications.
RESULTS: In the orthopedic unit (193 patients included), the average of inappropriate injections and the total injections of propacetamol per patient were significantly lower 1, 2, and 5 months after the intervention (respectively, 5.1 to 0.95 and 5.8 to 1.4; $p<0.001$). Acetaminophen cost per patient decreased by 62%, resulting in $20.50 in cost savings per patient and about $26,500 a year. The education intervention cost was paid off within 3 weeks. In the urologic unit, there were no significant differences found.
CONCLUSIONS: The education intervention effectiveness was immediate and remained fair during the 5-month study, providing substantial savings to the hospital and allowing reallocation of the nurses' time occupation.

266. Five cognitive pharmacy services in four innovative health care models in Australia: work in progress. *Shalom I. Benrimoj, Ph.D.*, Lance Emerson, M.S., Genevieve Peacocke, B.Pharm., Dip. Hosp. Pharm., Paula Whitehead, B.Pharm., Grad. Dip. Sci.; University of Sydney, New South Wales, Australia; Pharmacy Guild of Australia, Australia.

PURPOSE: To develop guidelines and standards of practice for the following pharmaceutical services: medication counseling, clinical interventions, medication management, preventive care, and participating in therapeutic decisions. To assess the provision of these services in health care models currently being trialed in Australia: coordinated care trials, multipurpose services, funder provider, and third party payer.
METHODS: Models of practice delivering these services were developed in nine conveniently selected sites around Australia. Pharmacists were paid up to $80 per hour for the provision of the services. Up to 100 hours of medication counseling, 250 clinical interventions, 600 medication management services, 100 preventive care services, and 200 hours of participating in therapeutic decisions will be delivered. The services will be clinically and economically evaluated using patient data from the Health Insurance Commission, including drug and medical utilization data, health insurance company data, and hospitalization data. An equal number of control patients will be followed.
RESULTS: Guidelines and standards have been developed and approved for each of the services. Over 30 community pharmacists are now providing services to patients in both rural and metropolitan areas. To date, 70 patients experiencing a range of medication management problems have been referred for a medication management service.
CONCLUSION: Clinical and economic analyses will allow a policy decision to be made concerning the inclusion of the remuneration of cognitive pharmaceutical services in these trial models. This is an example whereby there has been an opportunity to incorporate cognitive pharmaceutical services as health care models have evolved.

267. Improvements in clinical work practices and patient outcomes through provision of a quality-assured medication liaison service. *Danielle A. Stowassser, B.Pharm.*, David M. Collins, Ph.D., Treasure M. McGuire, B.Pharm., Gwynneth M. Petrie, Ph.C., FSHP; University of Queensland, Queensland, Australia; Princess Alexandra Hospital, Brisbane, Australia.

PURPOSE: This project evaluated the benefits of a quality-assured medication information service (Medication Liaison Service [MLS]) to primary health providers, in terms of patient and broader social outcomes.
METHODS: Patients recruited from surgical pre-admission clinics at the Princess Alexandra Hospital, Brisbane, Australia, were randomly allocated to an intervention group (INT; n=42) for whom a full medication history profile was obtained and confirmed with their family physician and community pharmacist. A medication liaison communication was subsequently sent to their primary health providers within 24 hours of discharge. A control group (CTRL; n=43), without MLS intervention, was also processed. A mail survey was sent 30 days post-discharge to all patients and to the primary health care providers of INT patients, to assess post-discharge utilization of health resources. SF-36 scores were obtained at admission and at 30 days post-discharge for all subjects.
RESULTS: Provision of the MLS produced significantly more clinical recommendations (INT 0.76 vs CTRL 0.44, $p<0.05$) during hospitalization, and was associated with improved functional health at 30 days post-discharge as assessed by the SF-36. Compared with CTRL subjects, INT subjects experienced improvements in six of eight SF-36 dimensions, fewer readmissions to the hospital (INT 0.048 vs CTRL 0.116), fewer visits to the community pharmacy (0.85 vs 1.41), and had fewer total family physician visits (1.28 vs 2.00) and unplanned visits (0.40 vs 0.85) within 30 days of discharge.
CONCLUSION: Medication liaison provides a circle of quality information from home to hospital and return, and its benefits can be monitored in terms of improved work flow practices, patient health status, and resource utilization.

268. A cost-minimization analysis of pharmacist-managed once-daily and multiple-daily aminoglycoside therapy. *Jack J. Chen, Pharm.D.*, T. Jeffrey White, Pharm.D., M.S., Glenn Y. Yokoyama, Pharm.D.; Huntington Memorial Hospital, Pasadena, CA; PacificCare Health Systems, Costa Mesa, CA.

PURPOSE: To evaluate differences in resource utilization between pharmacist-managed once-daily aminoglycoside administration (ODA) and multiple-daily aminoglycoside administration (MDA).
METHODS: This is a case-controlled cost-minimization analysis performed from a hospital perspective. Equivalent efficacy was assumed. Consecutive patients receiving pharmacist-managed gentamicin therapy during a 12-month period (1997 to 1998) were evaluated. The cohort studied were young (< 70 years of age) and renally-competent (CrCl > 60 ml/min) patients. Cases were excluded based on the presence of *P. aeruginosa* infection, neutropenia, and use of an aminoglycoside for synergy. Outcome measures include: the amount of drug and infusion-related supplies consumed, length of therapy, number of levels assayed, incidence of nephrotoxicity, and total cost of therapy to the hospital.
RESULTS: Of 515 consecutive cases, 275 met criteria for analysis. Of these, 71 patients (25.8%) received ODA and 204 (74.2%) received MDA. Mean age and baseline CrCl was similar in both groups. Mean cumulative dose per patient was greater in the ODA group (2223 mg) as compared to the MDA group (1169 mg), but median duration of therapy was similar (4 days). The ODA group required significantly less drug assays per patient (0.41 ± 0.65 [ODA] and 0.92 ± 1.2 [(MDA]; $p<0.01$) and the incidence of nephrotoxicity was similar (2.8% and 2.9%; respectively). The mean cost per patient was approximately U.S. $176 (ODA) and U.S. $268 (MDA). ODA resulted in a cost avoidance of U.S. $92 per patient treated. The cost avoidance was predominantly the result of a 2- to 3-fold greater consumption of admixture and infusion-related supplies associated with the MDA group.
CONCLUSION: At a community teaching hospital, pharmacist-managed ODA is associated with a significant reduction in laboratory- and pharmacy-related supplies with similar incidences of nephrotoxicity as compared to pharmacist-managed MDA.

269. Impact of pharmacists' intervention to asthmatic, diabetic, and hypertensive patients in a pharmaceutical care demonstration project. *Kathleen A. Johnson, Pharm.D., Ph.D.*, Francesca Venturini, Pharm.D., M.S., Joe Parker, M.S., Tripthi Kamath, M.S., Michael Rudolph, Pharm.D., Usa Chaikledkaew, M.S.; University of Southern California, Los Angeles, CA.

A pharmaceutical care (PC) model was implemented in three pharmacies to

provide care to asthmatic, diabetic, and hypertensive patients. Subjects were identified for the study based on pharmacy records. All participants were enrolled with one insurance company in a commercial HMO or a seniors Medicare HMO and received medical care from one of two geographically distinct medical groups (PMG1 and PMG2). Participants associated with PMG1 were assigned as controls (n=253) and participants from PMG2 (n=269) were invited to enroll in the study and receive disease management services from the pharmacist for 6 months. Sixty-four individuals signed informed consents agreeing to receive pharmacist services. Participants from PMG2 who elected not to receive pharmacist services, but completed baseline and follow-up surveys, were assigned as controls (n=205).
All participants were sent baseline and follow-up questionnaires about health behaviors, medication compliance, demographics, general (SF-36) and disease-specific quality of life, satisfaction with care, and use of services. A computerized disease management program was developed and used by the pharmacists for interventions, documentation, and patient education. Health behaviors, drug therapy problems, and disease management information were obtained by patient interview. When the pharmacist identified drug therapy or disease management problems, physician referral, recommendation, and patient intervention was provided to improve patient outcomes.
Sixty-four participants received PC services for 6 months (asthma, n=16; diabetes, n=29; hypertension, n=40). Pre-post comparisons of disease control, based on clinical measures and specific drug therapy problems, are evaluated. For all participants, baseline and 6-month data is analyzed to determine the impact of PC services on general and disease-specific quality of life, health behaviors, compliance, patient satisfaction, and quality of care indicators.

270. Cost justification of clinical pharmacy services in a group of community hospitals. *Hanan Mubarak-Shaban, Pharm.D.*, Steve R. Johnson, B.S.; Centura St. Anthony Central Hospital; St. Anthony North Hospital, Denver, CO.

Centura St. Anthony Central (SAC) and St. Anthony North (SAN) hospitals are part of a cooperation of nonprofit community hospitals located in Denver, Colorado. SAC is a 275-bed level 1 trauma and open heart center and SAN is an 80-bed acute care facility.
In the early 1990s we evaluated the need for clinical pharmacy services through a multidisciplinary redesign team. The model would have a clinical pharmacist assigned to each specialty area who would monitor drug therapy, with an emphasis on high risk drugs or patient groups; provide dosing consults; participate in nutrition support; provide drug information; and participate on any committees involving medication use. To fulfill these functions, the pharmacist would not have any distribution responsibilities; our satellites would be closed and all distribution would need to be handled through the main pharmacy.
We piloted two clinical pharmacist positions at SAC, one in general medicine and the other in surgery. Training took place for infectious diseases, laboratory monitoring, nutrition support, and pharmacokinetic models.
An intervention form was developed to document cost savings and clinical outcomes. Interventions were tracked with the goal of cost justifying the two positions and then expanding services. The pharmacists would need to save 1 1/2 times their salary, $75,000 each. Year 1 savings were $180,134. Over four years we have added three clinical positions at SAC and 2.5 positions at SAN. The cost savings were $222,800 in 1995, $360,644 in 1996, $680,504 in 1997, and $1,253,916 in 1998. In 1998, 11,321 interventions were made with an acceptance rate of 97%. The outcomes prevented included adverse events, 34%; readmission, 30%; and simplified or improved therapy, 55%. We conclude that clinical pharmacists can decrease costs and improve patient outcomes.

271E. Pharmacoeconomic impact of a single, shared, clinical pharmacist at multiple community hospitals. *Daniel P. Rodman, Pharm.D., BCPS*; Owen Healthcare, Inc., Kennesaw, GA.

Presented at the 33rd Midyear Clinical Meeting of the American Society of Health-System Pharmacists, Las Vegas, NV, December 6-10, 1998.

272. Patient satisfaction as an outcome of an over-the-counter medication counseling algorithm. *Matthew Perri, III, Ph.D.*, Somali M. Burgess, Ph.D.; University of Georgia, Athens, GA.

In addition to clinical success, patient satisfaction with health care interventions is an important outcome measure. The unique role of the pharmacist in self care and the widespread use of over-the-counter (OTC) medication emphasizes the need of assessing outcomes related to OTC use and self care. This study assessed patient outcomes of a pharmacy care intervention designed to structure care for OTC medications. The intervention was a clinical decision algorithm for counseling patients regarding OTC cough and cold medication use. A post-test only, control group design was employed to compare patient satisfaction between those receiving care via the algorithm (experimental group) and those who were not provided structured care (control group). The decision algorithm was developed through a process including a literature search, development by a panel of experts, pilot testing, and refinement. A total of 213 patients were provided care via the algorithm by 18 pharmacy interns. Another 210 patients were included in the control group. Patients were then surveyed to assess satisfaction with care in general, the structured care provided via the algorithm, and with the medication actually purchased or used. Regression results revealed patients in the experimental group reported significantly higher levels of overall satisfaction with care, satisfaction with counseling provided via the algorithm, and with the specific product used than patients in the control group. Overall satisfaction was nearly 20% higher in the experimental group when compared to the control group. The clinical decision algorithm was well accepted and demonstrated positive patient outcomes.

273. Pharmacy coordination of a care program to indigent patients with decreased hospital costs. *Diane Nykamp, Pharm.D.*, Dale Ruggles, B.S.; Mercer School of Pharmacy; Saint Joseph's Hospital, Atlanta, GA.

PURPOSE: To determine if patients were more adherent with their medication therapies and if this would result in a decreased number of inpatient and outpatient visits if medical care was provided to patients at no cost.
METHODS: Medically indigent patients who met criteria were enrolled into a 6-month assistance program. Patients selected for evaluation were those who had been hospitalized at Saint Joseph's Hospital Atlanta during the previous 6-month period, which ensured that before and after comparisons could be made. Adherence to medication regimens was measured in patients with chronic conditions.
RESULTS: Ninety patients were eligible for the program; thirty-six of these met study criteria. Inpatient admissions decreased by 34% (from 43 to 29) and outpatient visits decreased by 65% (from 194 to 68). This amounted to a decrease in hospital charges of $410,706. Medication costs during the program period were $28,000, which was 6.9% of total program costs. Patients who adhered to medication regimens provided an even greater cost savings to the hospital.
CONCLUSION: The costs associated with free medical care and prescription medications decreased overall costs to the hospital, especially when patients were compliant with medication use.

274E. Clinical intervention assessment: implementation of default values for expediting the calculation of cost savings and cost avoidances. *Alan H. Mutnick, Pharm.D.*, Teri L. Vrchoticky, Pharm.D., Kenneth J. Sterba, MBA, M.P.A.; The University of Iowa Hospitals and Clinics, Iowa City, IA; The Baptist Hospitals of Memphis, Memphis, TN.

Presented at the 3rd Annual Meeting of the International Society for Pharmacoeconomics and Outcomes Research, Philadelphia, PA, May 28, 1998.

275. The justification and expansion of clinical pharmacy services within a physician group practice. *Amy H. Schwartz, Pharm.D.*; Midwestern University, Downers Grove, IL.

BACKGROUND: In May 1995, Suburban Heights Medical Center (SHMC), a 50-plus multispecialty physician group practice, entered into an agreement with Midwestern University, Chicago College of Pharmacy (CCP), to initiate clinical pharmacy services. The services developed focused on anticoagulation and coronary heart disease risk management. Two clinical pharmacists (fully and co-funded by CCP) were involved with the project until November 1997, when the fully funded clinical pharmacist chose to pursue an alternate career opportunity. A proposal for a replacement practitioner, fully-funded by the clinic, was declined.
PURPOSE: To describe the processes involved with the justification of a replacement clinical pharmacist. An additional evaluation was undertaken to determine whether present services were congruent with clinic needs.
METHODS: The proposal outlined the financial and medical benefits obtained through the efforts of the remaining clinical pharmacist. Projections were depicted comparing these benefits with those that could be realized through expansions. The needs assessment evaluated physicians' opinions toward the services provided thus far, and future wants. The information from the needs assessment was used to strengthen the justification process.
RESULTS AND CONCLUSIONS: SHMC and CCP approved the proposal for the co-funded clinical pharmacist. SHMC made an additional provision for the possibility of procuring of a fully funded clinical pharmacist pending results. Approval was also obtained for development of a pharmacotherapy clinic, which will incorporate the previous services, but also allow for expansions.

276. Evaluating the economic impact of a pharmacist-managed hypertension program. *Catherine E. Cooke, Pharm.D., BCPS*, C. Daniel Mullins, Ph.D.; University of Maryland, Baltimore, MD.

PURPOSE: The objective of this study was to determine the economic impact of a pharmacist-managed hypertension program.
METHODS: The University of Maryland School of Pharmacy partnered with a local health maintenance organization for a faculty member to provide clinical pharmacy services for patients with hypertension. Patients with a diagnosis of hypertension were referred by their primary care provider to the

pharmacist. The pharmacist gathered information, performed a brief physical assessment, and made recommendations for drug therapy modifications. Resource utilization was gathered for two periods: 6 months prior to enrollment and 6 months after enrollment.
RESULTS: The first 50 enrolled patients were included in the economic analysis. This group (n=50) was primarily African-American (n=46) and female (n=37). The average age was 53 ± 9.7 years and their average weight was 200.5 ± 35.8 pounds. A statistically significant reduction was achieved for both systolic and diastolic blood pressures (BP). Based on this BP reduction, there was a decreased risk for myocardial infarction (MI) and stroke. In addition, there were 69 fewer physician visits in the 6 months after enrollment compared to the 6 months prior to enrollment. The costs avoided included the money attributed to fewer physician visits and reduced risk of myocardial infarction and stoke. The cost incurred took into account the pharmacist's salary and the increased cost of antihypertensive medications. Overall, the health maintenance organization was estimated to save $15,162-$22,961 per year.
CONCLUSIONS: Health care payers benefit from a pharmacist-managed hypertension program.

277. Cost avoidance for outpatient antiretroviral therapy in a VA medical center by pharmacist-initiated referral to investigational protocols. *Melissa D. Johnson, Pharm.D.*, Richard H. Drew, M.S., Carol D. Hamilton, M.D.; Duke University Medical Center; Durham Veterans Affairs Medical Center, Durham, NC.

PURPOSE: To calculate the cost avoidance associated with pharmacist-initiated referral of eligible HIV-infected patients from the Durham Veterans Affairs Medical Center (DVAMC) to the Duke University AIDS Research and Treatment Center (DART) for participation in antiretroviral research protocols.
METHODS: Patients were evaluated by an infectious diseases pharmacist during routine medication counseling for participation in research studies that would provide comparable or potentially superior therapy to that prescribed. Physicians and pharmacists discussed study participation with interested, eligible patients, who were referred to DART. Cost avoidance for antiretroviral therapy was calculated utilizing DVAMC acquisition cost of study medications or comparable therapy available at DVAMC.
RESULTS: Four of 12 HIV-infected patients referred to DART enrolled in antiretroviral clinical trials. Virologic success was achieved in two patients who are continuing study participation (weeks 48/84 and 15/96). One antiretroviral-experienced patient demonstrated virologic failure during a salvage therapy protocol (week 16), but has achieved virologic success with a subsequent salvage regimen at DVAMC. Another patient received efavirenz and adefovir through DART with salvage therapy and demonstrated significant improvement in surrogate markers (14 weeks). No protocol-related toxicities requiring treatment were observed. Annualized cost avoidance for medications was $21,865. This exceeded resource utilization (pharmacist salary plus benefits, 200 hrs/yr) by a ratio of 3.23:1.
CONCLUSIONS: Our data suggest that pharmacist-initiated referral to antiretroviral research protocols can save a significant amount of money for DVAMC without compromising patient outcomes. In addition, cost avoidance outpaced resource utilization for the study period.

278. Cost avoidance and clinical trials: impact of a study utilizing liposomal amphotericin B on purchases and patient outcomes. *Richard H. Drew, M.S.*, Tracy A. DeWald, Pharm.D., Carol D. Hamilton, M.D., John R. Perfect, M.D.; Duke University Medical Center, Durham, NC; Campbell University, Buies Creek, NC.

PURPOSE: In order to describe the impact of participation in a clinical trial, we 1) determined the cost avoidance associated with participation in a clinical trial utilizing liposomal amphotericin B (LAmB); and 2) compared treatment descriptions and outcomes with patients previously treated at our institution with amphotericin B lipid complex (ABLC).
METHODS: Patients eligible to receive a liposomal formulation of amphotericin B under previously approved institutional guidelines were identified and screened for protocol eligibility to participate in an open-labeled evaluation of LAmB. Consenting patients were enrolled and demographic, treatment description, and response data were collected. Cost avoidance was calculated based on the ABLC dose which would have been prescribed utilizing our institution's weight-based dosing nomogram and ABLC cost. Demographics and clinical outcomes of patients previously treated with ABLC were also collected.
RESULTS: A total of 774 treatment days were administered to 42 patients over approximately 6 months. Based on a range of assumption (from 0-15% waste recovery of partial vials), between 1675-1971 vials of ABLC were avoided, for a cost avoidance of $134,028-$157,680. Preliminary analysis of patient demographics and patient outcomes has revealed increased use of empiric therapy in pediatric patients. No obvious differences between outcomes in either treatment group have been detected. Final evaluation of patient outcomes is still ongoing.
CONCLUSION: Participation in clinical trials may not serve only to fulfill research missions of health care institutions, but may also serve to generate revenue and significantly avoid treatment-related monitoring and costs.

279. Documentation of the cost-savings impact of pharmaceutical care interventions at a tertiary care teaching hospital. *Thomas W.F. Chin, Pharm.D.*, Michael K.W. Wong, B.S., Diane Chong, B.S., Christa Cepuch, Gillian Feitelberg, B.S., Elaine Tom, B.S.; St. Michael's Hospital, Toronto, ON, Canada.

Several studies have documented cost savings associated with various types of clinical pharmacy services. However, there is a lack of data on the cost-savings impact of the provision of pharmaceutical care (PC) based on the Hepler and Strand model of PC.
PURPOSE: This project documented the types of PC interventions and their cost-savings impact in patients to determine if a positive benefit-cost ratio could be obtained.
METHODS: The PC model of care was implemented in two internal medicine units, a neurosurgical unit, and a medical-surgical intensive care unit. Four pharmacists working in these units prospectively collected data on drug-related problems (DRP) and interventions, and cost savings over a 10-week period. Types of DRP, interventions, acceptance, and time to provide PC were documented. Cost-savings was determined from drug cost-avoidance and prevention of increase in length of stay. Pharmacists' labor cost was the input cost used to calculate net cost savings.
RESULTS: Seven hundred eighty-eight DRP were documented in 361 patients. The three most common types of DRP related to no therapeutic benefit (12.4%), high dose (12.2%), and indication for therapy (10.5%). Acceptance rate for interventions to resolve all DRP was 93.7%. The total number of interventions resulting in cost savings was 309. Extrapolated annual cost savings was (Can) $318,748, with a net cost-savings of (Can) $168,306. Net cost-savings per intervention was (Can) $41. The overall benefit-cost ratio was 2.1:1.
CONCLUSION: This project demonstrated that provision of PC by pharmacists could result in beneficial clinical impact and cost-savings, with a positive benefit-cost ratio of 2 to 1.

280E. Cost benefit analysis of a pharmacist-managed anticoagulation clinic for patients with atrial fibrillation. *P. Hanus, Pharm.D.*, J. Evans-Shields, Pharm.D., T. Macri, B.S., A. Turel, M.D.; Penn State-Geisinger Health System, Danville, PA.

Presented at the American Neurological Association, Montreal, PQ, Canada, October 16, 1998.

281E. The effects of community-based pharmaceutical care services on asthma-related health care expenditures, utilization, and quality of life. Bethany Boyd, Ph.D., *Karen L. Rascati, Ph.D.*, Kenneth A. Lawson, Ph.D.; University of Texas, Austin, TX.

Presented at the 1998 Annual Meeting of American Pharmaceutical Association, Miami, FL, March 1998.

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282. Interactive pharmaceutical care: the impact of daily, therapeutic recommendations, based on pharmacy profile reviews, from a clinical pharmacy service to physicians. *J. Lynn Bass, Pharm.D.*; Kaiser Permanente, Woodbridge, VA.

PURPOSE: The primary purpose of this project was to determine the potential impact of innovative, clinical pharmacy services on prescribing practices in an ambulatory managed care setting. Secondary goals were to improve provider adherence with formulary medications and to positively impact patient medication compliance through reinforcement from the physician staff.
METHODS: The clinical pharmacist's office was located in the internal medicine/family practice clinics for ease of communication and accessibility. The project was conducted over approximately 4 hours per week for 6 months, from July 1997 through April 1998 (excluding September through November 1997). The clinical pharmacist reviewed pharmacy profiles for the next day's appointment schedule for one of the following: 1) chronic medication noncompliance based on the pharmacy profile refill schedules, 2) nonformulary to formulary conversion opportunities, and 3) disease state recommendations based on pharmacy utilization and available laboratory information. Clinical pharmacy recommendations were recorded with individual patient details, and then personally distributed, on the day of the appointment, to the physician with whom the patient had a scheduled appointment. The physicians responded to the recommendations following the patient visit. The information obtained from these recommendations was compiled using a commercially available documentation program.
RESULTS: There were a total of 247 daily pharmaceutical care recommendations. Of these, 24% were related to noncompliance. Formulary conversion recommendations accounted for 33% of the total. Estimated annual cost savings based on these formulary conversions was approximately $30,900. Disease state recommendations accounted for 43% of the total. Overall, the acceptance rate of the recommendations was 85%.
CONCLUSION: Innovative practices that use pharmaceutical care as their

basis may offer a range of benefits. In our setting, incorporating a clinical pharmacist into the medical clinic setting had a positive impact on both patient and budgetary outcomes. In addition, this project gave us an additional opportunity to promote our formulary initiatives. Based on the information obtained in this pilot and the reception from the physician staff, we plan to extend this program to other medical centers within our network.

283. Double-blind clinical studies: the value of pharmacy services for investigational drug packaging. *Blandine Lehmann, Ph.D.*, Annick Tibi, Dominique Pradeau; Pharmacie Centrale des Hôpitaux, Paris, France.

For institutional clinical studies, hospital pharmacists are responsible for the supply of investigational medicinal products. The double-blind labeling and packaging are of major importance when needed. These operations are very specific and are totally different from any other packaging of drugs in pharmacy. Moreover, they must comply with good manufacturing practices (GMP) requirements for investigational products. The pharmaceutical quality and the perfect traceability of the drugs (verum, placebo, comparator) during packaging operations are one of the keys to patient safety, the quality of the clinical trial, and the validity of the results.
With that goal in mind, we have first identified the main risks before, during, and after the labeling and packaging of the drugs: cross-contamination; errors of drug, randomization code, expiration date, or batch number; and non-similarity of the drug and its comparator. Then, we developed a specific quality assurance system with respect to the GMP (trained staff, dedicated areas). The quality assurance system is based on general procedures dealing with the general organization of our unit. We also developed specific instructions for each clinical trial taking into account its specificities. We focused mainly on packaging procedures, labeling and packaging batch records, and on a total tracking of all operations. The release of batches and the final product assessment are under the responsibility of an independent pharmacist.
As a result of this organization, we are responsible for packaging and labeling drugs used in more than 20 different double-blind clinical trials. To date, our quality assurance system has been able to ensure a high quality of pharmaceuticals for all double-blind studies with regard to trial validity.

284. Clinical pharmacy and epidemiologic research in primary care. *Ruccolo Maria Grazia*, Francesca Ravaioli, Marilena Romero; Consorzio Mario Negri Sud, Chieti, Italy.

PURPOSE: Clinical pharmacy activities have the potential to improve the quality of care both in hospital and ambulatory practice. In Italy in the last few years, the collaboration between clinical pharmacists and general practitioners was begun to plan epidemiologic studies. This pilot study has the objective of verifying the possibility for clinical pharmacists to promote and coordinate national epidemiologic surveys and the possibility of creating a multidisciplinary working group for disease management purposes.
METHODS: The following steps were part of the process: 1) constitution of a core group of pharmacist coordinators, 2) identification of a critical area in need of surveillance (e.g., asthma), 3) definition of the study protocol and data collection forms, and 4) dissemination of information about the study and recruitment of interested physicians.
RESULTS: A team of 18 pharmacists was established. One hundred thirty-seven physicians were recruited by pharmacists (average 8 physicians/pharmacist, range 3-15). In February 1998, a perspective surveillance of asthmatic patients started. The protocol consisted of a patient recruitment phase (6 months) and a follow-up phase (1 year). Three forms are to be filled out: at recruitment, and at follow up 6 and 12 months. At present, 734 patients are recruited, of whom 65% were called for a first follow up, and 32% for the conclusive follow up. The study will be completed December 1998.
CONCLUSIONS: A new role of clinical pharmacist as promoter and local coordinator of clinical research among general practitioners was tested. The established multidisciplinary team will be used as a model to increase knowledge on disease management and improve quality of care.

285. Establishing the pharmacist as a member of the clinical health team. *Kirsten K. Viktil, pharmacy candidate*, Elspeth K.F. Walseth, B.S., pharmacy candidate; Diakonhjemmets Sykehusapotek, Oslo, Norway.

Clinical pharmacy practiced on a regular basis is not established in the majority of Norwegian hospitals. However, regular clinical pharmacy service to the rheumatological department at Diakonhjemmets Hospital, Oslo, has been established. The inclusion of the pharmacist in the clinical health care team has received positive evaluation from doctors and nurses. It seemed, therefore, relevant to extend the service to the medical department.
The concept of clinical pharmacy and outcomes was presented to the physicians of the department. In agreement with the chief consultant, a plan for the activities of two pharmacists on two medical wards was compiled.
Once or twice per week the pharmacists attended morning meeting on their respective wards, where suggestions for intervention were discussed with the physician. The medication charts and laboratory results were checked in advance to identify drug-related problems. In order to document contributions, a short personal log was written by the pharmacists after each meeting. At the cessation of the period, the pharmacists drew up schematic summaries of suggestions and outcomes. A questionnaire was sent to physicians and nurses.
Physicians stated they regarded the pharmacist as a partner in discussions concerning drugs and drug therapy. We experienced that our suggestions regarding intervention had both a preventive effect and also contributed to improved treatment of individual patients. The number of interventions and the economic outcome of the pharmacist's contributions have not been quantified, as suggestions regarding intervention were a contribution to the shared decision of the clinical health care team.

286. A validation method to document the value of the community pharmacist when responding to symptoms. *Lilian M. Azzopardi, B.Pharm., M.Phil.*, Sam Salek, Ph.D., Anthony S. Inglott, Pharm.D., Maurice Zarb Adami, B.Pharm.; University of Malta, Malta; Welsh School of Pharmacy, United Kingdom.

PURPOSE: Documentation of the value of pharmacy services can take different formats. One way this was attempted for community pharmacy practice was by developing a validation documentation system intended to monitor the standards of professional services provided by community pharmacists.
METHODS: The validation process consists of a series of measurement instruments which are based on a quantitative system. Each tool consists of a series of statements which appraise professional services provided by community pharmacists. The Responding to Symptoms tool assesses the procedure adopted by the pharmacist when responding to 17 common ailments. Face and content validity of the tool were assessed through an organized review of the tool by a specially set panel discussion. Practicality and applicability of the validation tool were assessed when two raters used the tool in a community pharmacy and assessed ten procedures. To assess inter-rater reliability, the tool was used in ten randomly selected community pharmacies by two different raters. Factor analysis was carried out using BMDP software. Correlation coefficient was used to assess inter-rater reliability. Internal consistency was measured using Cronbach's alpha.
RESULTS: The raters reported that the tool was practical to use through observation in a community pharmacy (average time to use the tool was 5 minutes). The correlation coefficient for the tool was found to be high (r_s=0.850). Internal consistency for the tool was also high (alpha = 0.92).
CONCLUSION: The tool was shown to be a valid and reliable method to document the value of clinical pharmacy services provided by community pharmacists.

287. Home hospitalization: an evaluation of the necessity for a permanent pharmaceutical service 24 hours a day and 7 days a week. *Renaud Pichon*, Anne-Lise Vodoz; Service de Pharmacie Clinique Ambulatoire, Geneva, Switzerland.

PURPOSE: Home hospitalization allows patients to return home sooner and to benefit from particular and heavy medical treatment in their own surroundings, including antibiotherapies, TPN, palliatives care, hyperhydrations pre- and post-chemotherapy, enteral nutritions, and hydrations. With the goal of being able to provide the same treatments available in the hospital and to guarantee the security of the patient, the home hospitalization team composed of physicians, nurses, and clinical pharmacists must be available 24-hours-a-day and 7-days-a-week. The object of this research is to estimate the importance and the necessity of this type of service by the clinical pharmacist.
METHODS: Quantitative and qualitative analysis of interventions done at home by clinical pharmacists during one year outside working hours.
RESULTS: A total 368 calls were made.

	Total	Home Hospitalization Installation	Interventions Permitting Continuation of Treatment	Communication Relating Patient Follow Up	No Urgent Order	Other Calls
Requiring an intervention at home	185	68	105	0	5	7
Problem resolved by phone	183	0	45	47	27	64

CONCLUSIONS: 1) Home hospitalization allows some patients to shorten their hospitalization. It permits them to keep their social and professional activities. 2) Home hospitalization treatments use drugs with strong effects. The guarantee of security requires of all the health partners a specific, technical, and therapeutic knowledge, and a fast and constant availability. 3) The number and type of interventions demonstrate the need for a 24-hour-a-day and 7-day-a-week service to guarantee home hospitalization treatment.

288E. Consulting pharmacy, the Nor-Way. *Elspeth K. Walseth, B.S., pharmacy candidate*, Tor Rise, pharmacy candidate, Turid Veggeland, pharmacy candidate; Diakonhjemmets Sykehusapotek, Oslo, Norway; Sykehusapoteket i Tønsberg, Tønsberg, Norway; Sykehusapoteket i Skien, Skien, Norway.

Presented at Nordisk Farmasikongress, Copenhagen, Denmark, June 7-10, 1998.

289. Criteria and final indicator of the therapeutic process associated with pharmaceutical interventions. Isabelle Garreau, Pharm.D., Karim Belkacem, Pharm.D., Marie Françoise Beck, M.D., *Michel Juste, Pharm.D.*; Auban-Moët Hospital, Epernay, France.

Development and maintenance of clinical activities needs rigorous documentation and a continuous evaluation of the interventions of the pharmacy team. The aim of this study is to validate some criteria and final indicator of the therapeutic process in order to confirm the value of pharmaceutical interventions.
This retrospective study is based on the pharmacotherapeutic plans which were elaborated for antibiotic treatments between January 1997 and June 1998. Every pharmacotherapeutic plan is built with one or several clinical interventions based on drug-related problems. Patient files were examined and clinical outcomes were evaluated with nine criteria that were chosen from the literature (e.g., organism eradicated, fall of temperature, nephrotoxicity). Each clinical outcome was classified as satisfactory (one or several positive criteria without any negative criteria), unsatisfactory (one negative criteria), or very unsatisfactory (two or more negative criteria).
Two hundred thirteen pharmacotherapeutic plans (39% of the patients are over 75 years old) were collected and 191 files were examined for evaluation. Three hundred seventy-seven criteria were notified and the overall classification gave 150 satisfactory (78.5%), 34 unsatisfactory (17.8%), and 7 very unsatisfactory (3.7%) outcomes. Negative clinical outcomes represent 25 events (13%) of therapeutic failure and 16 events (8%) of appearance of new medical problems. Some of the criteria are more sensitive and/or more specific then others.
Optimal therapeutic outcome can be defined as an absence of drug-related problems. Some criteria used in this study must be redefined and an indicator of morbidity (SIP, GIS, Apache II) added to refine further evaluations.

290. Evaluation of the contribution of pharmaceutical interventions: peer review. Karim Belkacem, Pharm.D., Isabelle Garreau, Pharm.D., Corinne Derarhoutunian, Pharm.D., Catherine Schweich, M.D., Eric Beck, M.D., Patric Zamparutti, Pharm.D., *Michael Juste, Pharm.D.*; Auban-Moët Hospital, Epernay, France; Lucien Hussel Hospital, Vienne, France; La Revue Prescrire, Paris, France.

In our hospital, the pharmacy department is responsible for drug orders review and dispensing medicines. During the drug orders review, all drug-related problems defined by Strand (1990) are documented on a pharmacotherapeutic plan and their potential clinical outcome is assessed by clinical pharmacists as minor, significant, severe/fatal, or of no effect.
To focus the role of the pharmacist on patient need and patient outcome, we asked two physicians and two pharmacists with clinical pharmacology experience to assess pharmaceutical interventions that have a significant clinical outcome, according to the pharmacists. Sixty-five pharmacists' interventions were evaluated (56 clinical situations).
This retrospective study was carried out between January 1997 and June 1998. The questionnaire made from the Bayliffs' (1990) and Rupps' (1992) works, requested information on the clinical impact of pharmaceutical interventions, on the probability of a clinical outcome, and on prolongation of hospital stay if the intervention had not occurred. The majority of assessors (87%) indicated that the pharmacists' interventions had a positive effect on therapy. A good correlation was found between the potential clinical consequence pointed out by the assessors and the drug-related problem. The assessors estimated that 172 days of hospitalization were prevented by beneficial interventions during these 18 months and the cost that was avoided as a result of pharmacists' intervention activities was estimated to 334,000 French francs per year.

291. Systematic review of the validity, reproducibility, and generalizability of studies classifying hospital pharmacists' recommendations on patient care. *Sorrel A. Abbott, M.S.*, John A. Cromarty, M.S., John G. Hamley, M.S., Norman A. Lannigan, Ph.D.; The Robert Gordon University, Aberdeen, United Kingdom; Ninewells Hospital, Dundee, United Kingdom; Western General Hospital, Edinburgh, United Kingdom.

PURPOSE: To critically appraise published classification systems to describe or evaluate pharmacists' recommendations to patient care.
METHODS: Systematic search included Medline, International Pharmaceutical Abstracts, Embase, and Pharmline. Search terms included: "clinical pharmacy", "pharmaceutical care", "hospital pharmaceutical services", "intervention", "evaluation", and "acceptance". Included were original research articles, in English, using a classification system to describe, monitor, or evaluate clinical pharmacy services to individual patients. Excluded were letters or abstracts, and research on individual drugs or therapeutic classes. A checklist and scoring system were developed. The checklist contained 11 quality of reporting (QoR) and 16 methodologic quality (MQ) criteria. Face validity was assessed by four pharmacists. One reviewer assessed all articles; intra-rater and inter-rater reliability were calculated.
RESULTS: One hundred one articles published between 1973 and 1998 were included. Less than 30% of articles met the QoR criteria relating to sampling: sample characteristics, operational definitions, data collection and analysis, and classification systems. Less than 10% of articles met four of nine MQ criteria relevant to study validity: accuracy and completeness of data, classification validity, assessments of accepted and rejected interventions, and clinical significance. Reproducibility was adequately assessed in only one study. Statements of generalizability were supported in 36% of studies.
CONCLUSIONS: Deficiencies in QoR obscured the exact circumstances under which studies were performed and limited assessment of MQ. Serious flaws in MQ were also apparent. This literature contains much information, the generalizability of which was limited by poor study design and small sample sizes. Recommendations are made for future studies.

292. Clinical interventions in a domiciliary pharmaceutical care scheme. *Chris J. Cairns, M.S., M.R.Pharm.S.*, Helen Marlow, B.Pharm., M.R.Pharm.S., Nicos Efithymion, B.S., M.R.Pharm.S., Mark Robinson, M.S., M.R.Pharm.S., David B. Hargreaves, M.Pharm., M.R.Pharm.S., Andrew McCoig, B.Pharm., M.R.Pharm.S.; St. George's Hospital, London, United Kingdom; Croydon Health Authority; Mayday University Hospital; Thornton Health.

PURPOSE: Domiciliary visiting provides the pharmacist the opportunity to review housebound patients' medication and pharmaceutical care needs in the context of their living environment. These patients may otherwise not be seen by a pharmacist. In the Croydon Domiciliary Pharmaceutical Care Project, the community pharmacists providing the service were expected to carry this out at each visit.
METHODS: Data were collected using an intervention record form based on those used in hospital intervention monitoring schemes.
RESULTS: During 195 visits to 157 patients, 181 interventions were identified. Most (167) were made on the first visit with 13 on a second visit. Compliance issues were the most common reason (78), along with inappropriate drug (14), inappropriate dose (13), medicine presentation (11), and side effect/adverse drug reaction (10). The doctor was contacted and a change made in 54 cases, pharmacist action alone was taken in 37, and information only was provided in 11. Clinical significance was judged to be potentially serious in 46 cases, a major nuisance in 33, a minor nuisance in 62, trivial in 8, and informational only in 8. Cardiovascular system drugs (BNF Chapter 2) were most frequently involved (108, 47%), followed by gastrointestinal (BNF Chapter 1; 40, 18%), and central nervous system (BNF Chapter 4).
CONCLUSION: Domiciliary visiting allows pharmacists to contribute to the clinical care of patients that may not otherwise benefit.

293. The Croydon Domiciliary Pharmaceutical Care Project. *Chris J. Cairns, M.S., M.R.Pharm.S.*, Helen Marlow, B.Pharm., M.R.Pharm.S., Nicos Efithymion, B.S., M.R.Pharm.S., Mark Robinson, M.S., M.R.Pharm.S., David B. Hargreaves, M.Pharm., M.R.Pharm.S., Andrew McCoig, B.Pharm., M.R.Pharm.S.; St. George's Hospital, London, United Kingdom; Croydon Health Authority; Mayday University Hospital; Thornton Health.

PURPOSE: In the United Kingdom, evidence has been accumulating on the need for domiciliary pharmaceutical services for housebound patients. In Croydon, domiciliary pharmaceutical care is provided by community pharmacists for selected elderly patients discharged from hospital or referred by their general practitioner (GP).
METHODS: Data were collected by pharmacists at each domiciliary visit, aggregated, and analyzed using Epi Info Version 6.0.
RESULTS: One hundred ninety-five visits were made to 152 patients, some who had more than one visit. A medication problem was identified in 89 patients, the most common being confusion over how to take medicines (22) and not taking all medication. A variety of actions were taken to address these problems, including provision of a medication aid (23), informing the GP (13), and providing information (10). Compliance problems were seen on 113 visits, with confusion (31) and forgetfulness (25) being the most common reasons. Again, a variety of methods were used to address these problems, including compliance aids, explanation, and working with a caregiver. Evidence of improved compliance was seen at 37 subsequent visits. Unnecessary medicines were found in the home in 83 cases and were destroyed. Medication counseling was provided on 158 visits, general in 69 instances; 111 specific issues were addressed in 89 patients.
CONCLUSIONS: Domiciliary visits by community pharmacists lead to the identification and resolution of pharmaceutical care issues in housebound patients which might have not otherwise been addressed.

294E. Factors affecting billing for cognitive services by community pharmacists in Quebec. Edeltraut Kröger, M.S., Jocelyne Moisan, Ph.D., *Jean-Pierre Grégoire, M.P.H., Ph.D.*; Université Laval, Quebec City, PQ, Canada.

Published in Pharmacoepidemiology & Drug Safety 1998;7:S160.

295. Evaluation of clinical pharmacy interventions: pharmacy school faculty, resident, and student contributions. Charles T. Taylor, Pharm.D., *Chelsea L. Church, Pharm.D.*, Leigh A. McDonald, Pharm.D. candidate, Debbie C. Byrd, Pharm.D., Jeffrey A. Lee, M.S.; Auburn University, Auburn, AL; DCH Regional Medical Center, Tuscaloosa, AL.

PURPOSE: To describe clinical interventions of pharmacy faculty, residents, and students in a regional medical center and to characterize the significance and value of services rendered.
METHODS: Data were prospectively collected from September 1, 1997 to September 1, 1998 on a computer-based tracking program to determine the number and type of interventions documented by full-time faculty members

(n=2), residents (n=4), and students (n=14). Data analysis included identification of intervention type, significance, and estimated cost savings.
RESULTS: A total of 1490 interventions were documented. The ten most common were: patient counseling (23%), therapeutic consultation/recommendation (16%), pharmacokinetic monitoring (14%), drug indication/dose adjustment (9%), route conversion (7%), therapeutic indication/duplication (6%), antibiotic selection (5%), drug interactions (3%), order clarification (3%), and drug information (2%). A total of 866 of 1490 (58%) interventions were further classified as medium-high significance, indicating a positive impact on patient care. The estimated cost savings for interventions was $100,150 ($67/intervention). This compared favorably to the pharmacy department (33 FTEs): 8981 interventions; $437,310 ($49/intervention); medium-high significance (46%).
CONCLUSIONS: Pharmacy faculty members, residents, and students accounted for 14% of the total interventions documented, and 19% of the estimated cost savings of the pharmacy department. This study demonstrated a clinical and economic value of supporting pharmacy education in a health organization.

296. What's left in the medicine cabinet? The British Columbia EnviRx Project. *Timothy-John Grainger-Rousseau, Ph.D.*, David W. Fielding, Ed.D., M. Anne Smith, B.S., Derek Daws, B.S., Derek Desrosiers, B.S.; University of British Columbia; British Columbia Drug and Poison Information Centre, Vancouver, BC, Canada; British Columbia Pharmacy Association, Richmond, BC, Canada.

PURPOSE: This study describes the types, costs, and reasons for non-use and return of drugs discarded through the British Columbia (BC) EnviRx drug disposal program. In addition, selected patient demographics are provided.
METHODS: We made a random selection of at least 10% of the 689 community pharmacies in British Columbia, Canada. Study pharmacists were sent a package of detailed instructions and data collection forms. Data were collected over 8 weeks.
RESULTS: Eighty-three pharmacies completed the study. A total of 581 patients returned 1966 separate medication items with a total cost value of $44,768. In this sample of patients, 63% were over 65 years old and 59% were female. Prescription medications accounted for 88% of the returns. The top four therapeutic groups for returns were cardiovascular, analgesics, psychotherapeutics, and systemic antiinfectives. The top three reasons for return were patient deceased, medication expired, and physician order changed. For cardiovascular drugs, the most common reason for return was that the physician had changed the order.
CONCLUSIONS: This study demonstrated that the cost of drugs returned ($45,000) over a period of 8 weeks in 83 pharmacies, if extrapolated to the total number of pharmacies in British Columbia for one year, would be just under $2.5 million. Although this is a simple extrapolation, it does highlight a potential area for cost saving. There is a need to evaluate methods that may reduce this waste such as the implementation of strategic drug prescribing, monitoring, and management policies that address inappropriate drug utilization.

297. Pharmacist's involvement in discharge planning and telephone follow up from the general medicine service. *Victoria J. Dudas, Pharm.D.*, Tom Bookwalter, Pharm.D., Herman Wong, Pharm.D., Robin L. Corelli, Pharm.D.; University of California San Francisco Medical Center, San Francisco, CA.

PURPOSE: The changing health care environment places great emphasis on improving patient satisfaction and outcomes. Patients may encounter medication-related problems post-discharge if there is inadequate discharge planning. Pharmacists can improve patient outcomes through early involvement in the discharge planning process and by providing telephone follow up shortly after the patient has been discharged from the hospital. This service would also ensure continuity of care in the transition from the inpatient to outpatient setting.
METHODS: Since June 1997, all patients on the adult general medicine service who received a pharmacy-facilitated discharge also received a follow-up phone call within 48 hours after discharge. A pharmacy-facilitated discharge is when a member from the pharmacy service provides patient counseling and makes arrangements for the patient to obtain medications. This includes telephoning discharge prescriptions to the patient's pharmacy and completion of any necessary third-party insurance forms. Patients must be discharged to home to receive this service. During the follow-up phone call, the pharmacist assesses the patient's understanding of the discharge plan, verifies that the patient acquired the medications, and attempts to resolve any other medication-related problems.
RESULTS: From June 1997 to May 1998 there were 765 pharmacy-facilitated discharges. Eighty-five percent (654/765) of these patients were successfully contacted. Fourteen percent (92/765) experienced drug-related problems at the time of the phone call, 89 of which were solved by the pharmacists.
CONCLUSIONS: Pharmacist involvement in the discharge planning process enables the pharmacist to solve medication-related problems, thereby potentially increasing patient satisfaction and improving outcomes.

298. Influencing the market share of H_2-antagonists and HMG-CoA reductase inhibitors to contain patient and plan costs in a university internal medicine clinic. *Debra J. Barnette, Pharm.D.*, Donna L. Grier, Pharm.D., Jeff Markoff; University of Colorado, Denver, CO.

PURPOSE: The purpose of this study was to measure the effect of a patient-specific flier to encourage therapeutic switching. The target medications included the HMG-CoA reductase inhibitors and the H_2-antagonists.
METHODS: One hundred twenty-seven patients were identified from a prescription claims database using recent fills of the targeted non-preferred medications. An intervention flier was designed and placed in the patient office medical record. The flier included medication and dose suggestions for more cost-effective alternatives, pertinent laboratory data, and patient copayment savings information. Providers were asked to consider a switch at the next office visit or when renewal of a non-preferred medication was requested.
PRELIMINARY RESULTS: From May to September 1998, the market share of simvastatin decreased from 47% to 27%. This resulted in decreases in the average reimbursed cost per prescription of 14% ($87.00 to $74.79) and in patient copayment of 24% ($23.85 to $18.04). The market share of nizatidine decreased from 47% to 25%. This resulted in a decrease in the average reimbursed cost per prescription of 25% ($64.24 to $48.34) and in patient copayment of 38% ($20.84 to $13.01). The plan is expected to save approximately $19,000 yearly due to these interventions. Data to evaluate whether appropriate follow-up laboratory tests were completed is currently in progress and will be presented.
CONCLUSIONS: Patient-specific intervention fliers proved to be an effective process to influence the market share of the HMG-CoA reductase inhibitors and H_2-Antagonists. The intervention resulted in cost savings to plan members and the plan.

299. Analysis of pharmaceutical care provided by a clinical pharmacist in a renal transplant clinic. *Marie A. Chisholm, Pharm.D.*, Tana R. Bagby, Pharm.D., Joseph T. DiPiro, Pharm.D., J. Russell May, Pharm.D.; Medical College of Georgia School of Medicine, Augusta, GA; University of Georgia, Athens, GA.

PURPOSE: Data regarding pharmaceutical care activities were prospectively collected for 6 months after beginning the program in October 1997. Objectives included: 1) identifying, documenting, solving, and preventing medication-related problems; 2) documenting the number and types of recommendations made by the clinical pharmacist to the clinic's physicians; 3) determining the physician acceptance rate of these suggestions; and 4) determining the potential impact of the clinical pharmacist's recommendations on patient care.
METHODS: The clinical pharmacist visited clinic patients, performed medication reviews, was responsible for preventing or resolving patients' medication-related problems, and provided appropriate pharmacotherapy recommendations. All recommendations that were made by the renal transplant clinical pharmacist from October 1997 to April 1998 were classified according to medication-related problem and class of medication. Two pharmacists (other than the renal transplant pharmacist) independently evaluated each accepted recommendation using Hatoum's criteria to assess potential impact on patient care.
RESULTS: During the 6-month study period, approximately 96% (n=275) of the recommendations were accepted by the clinic's physicians. Untreated indication (31%), overdosage (25%), and subtherapeutic dosage (16.4%) accounted for greater than 72% of the medication-related problems. The most commonly accepted recommendations involved cardiovascular (33.8%) and immunosuppressant (33.5%) medications. Greater than 96% of the recommendations were judged to have a significant (72%) or a very significant (24.4%) potential impact on patient care.
CONCLUSION: During the first 6 months of the renal transplant clinical pharmacy services, the pharmacist performed pharmaceutical care activities that were well received by the clinic's physicians and had a positive potential impact on patient care.

300. The use of a handheld computer for patient data collection. *David M. Hachey, Pharm.D.*, Rex W. Force, Pharm.D., BCPS, Charles D. Lawless, Pharm.D., Vaughn L. Culbertson, Pharm.D.; Idaho State University, Pocatello, ID.

PURPOSE: Handheld computers are being used more frequently today in the fields of pharmacy and medicine. Applications range from patient scheduling to drug information. Patient data collection and medical records are an area of growing interest. The purpose of this descriptive report is to discuss the value of a handheld computer for patient data extraction and applications to patient care.
METHODS: Pharmacy residents used a handheld computer (Palm III™) to collect data on inpatients and outpatients. Computerized collection forms were designed using Pendragon Forms™ with various data fields to collect patient-specific information. Data were entered into the computers on admission to the hospital or first clinic visit. Medications and labs were then updated continuously. These data were then downloaded to spreadsheet and database programs on a personal computer.

RESULTS: The data served several purposes. First, for inpatients, the data were convenient for the pharmacist, attending physicians, and residents on rounds as all patient information was readily available without having to search through charts. The outpatient information was beneficial as there were updated medication lists and laboratory reports available to the pharmacist and physician at every patient visit. Finally, the data were used to help document drug-related problems and pharmaceutical diagnoses.
CONCLUSIONS: The handheld computers served as a versatile, convenient, and useful tool to manage information efficiently. Adaptation of this technology can be effectively utilized by various clinicians.

301. Success of a pharmacy-driven communication and education strategy to decrease albumin use at an academic medical center. Fotini K. Hatzopoulos, Pharm.D., *Elizabeth G. Young, Pharm.D.*; University of Illinois at Chicago Medical Center, Chicago, IL.

PURPOSE: Albumin has been in short supply since 1997, and acquisition costs have increased. We describe a proactive communication and education strategy that facilitates managing the short supply and encourages appropriate use of albumin at the University of Illinois at Chicago Medical Center (UICMC).
METHODS: In September 1998, a letter was sent by both conventional and electronic mail to pharmacists, physicians, and nurses addressing the albumin shortage and discussing the consequences of its misuse (Brit Med J 1998;317:235-40). Reference was made to albumin guidelines posted in pharmacy areas emphasizing alternatives such as crystalloids and non-protein colloids. A message about the shortage was also entered into the physician order system. Albumin was removed from floor stock and centralized in the pharmacy areas. In addition, a usage log was developed and weekly inventory was taken. Pharmacy dispensing and intervention procedures were developed. Indications were screened for appropriateness using the University HealthSystem Consortium guidelines (Arch Intern Med 1995;155:373-9) and internally developed pediatric guidelines. Albumin administration and UICMC data for total patient days, average census, and number of patient discharges for 1996 through 1998 were compared.
RESULTS: All albumin use decreased substantially. Albumin 5% 250 ml use in October 1998 was 80% lower than October 1996 and October 1997. Patient days, average census, and patient discharges were similar in all three time periods. An adequate supply of albumin was available at all times.
CONCLUSION: Albumin use decreased at UICMC as a result of a successfully implemented pharmacy-driven communication and intervention strategy.

302. Comparison of outcomes for antithrombosis clinic patients managed in the clinic versus over the telephone. *Jennifer L. Mitchell, Pharm.D.*, Michael J. Wong, Pharm.D. candidate, Edith Nutescu, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

PURPOSE: Pharmacotherapists in the antithrombosis clinic (ATC) manage patients on anticoagulant therapy. This study was designed to compare international normalized ratio (INR) control and hospitalizations or emergency department (ED) visits due to bleeding or thromboembolic events, in telephone- versus clinic-managed patients taking warfarin.
METHODS: Most ATC patients have face-to-face interactions with a pharmacotherapist, but patients unable to be seen in clinic regularly are counseled over the telephone. Data from patients managed by the ATC from October 1996 to October 1998 were collected through a retrospective chart review. Patients were divided into the telephone group and clinic group based on how they were followed by the ATC at least 75% of the time.
RESULTS: To date, chart review has been completed for 78 patients (26 telephone, 52 clinic) with 96.2 patient years of data (61.5 clinic, 34.7 telephone). The mean patient age was 57.4 years. Most patients were female (61.5%), anticoagulated for secondary stroke prevention (73.1%), and had a goal INR of 2-3 (73.1%). In the telephone group, 78.6% of INR values were therapeutic (11.6% above, 9.8% below) compared to 74.9% in the clinic group (11.5% above, 13.6% below). The telephone group had one ED visit and five hospitalizations (2.9 and 14.4 events per 100 patient years, respectively). In the clinic group, there were six hospitalizations (9.8 per 100 patient years).
CONCLUSION: Preliminary results show that telephone group patients had a larger percentage of therapeutic INRs but a higher incidence of ED visits and hospitalizations. Final data will be presented on all patients.

303. Impact of the patient-focused care model on clinical pharmacy workload. *Steven R. Abel, Pharm.D., FASHP*, Carol W. Birk, M.S.; Purdue University; Clarian Health Partners, Indianapolis, IN.

PURPOSE: The purpose of this report is to describe the impact of the patient-focused care (PFC) model for provision of inpatient care on clinical pharmacy workload.
METHODS: Within the PFC model, pharmacists and other health care professionals were assigned to care teams managed by nurses. Our hypothesis was that inclusion of pharmacists in PFC teams would increase exposure of other health care professionals to clinical pharmacists and the demand for clinical services would increase accordingly. Since 1980, pharmacists have manually documented their clinical pharmacy activities. Based on this documentation system, our study compared the frequency of provision of various clinical pharmacy services during a control period (1992-1993) without PFC and during the first year following implementation of the PFC model (1995-1996).
RESULTS: The frequency of completion of various clinical pharmacy activities increased, equivalent to an additional 9.9 FTE clinical pharmacists. This demand was met by realignment of pharmacist responsibilities and increased involvement of Pharm.D. students in direct patient care. The greatest increase in demand occurred for the provision of patient education, chart reviews, responses to drug information inquiries from physicians and nurses, and provision of patient-specific therapy consultations. The largest increases in consultations for patients not routinely monitored by a clinical pharmacist occurred on pediatric cardiology, developmental, and gastroenterology services and adult gastroenterology, neurology, neurosurgery, orthopedics, and plastic surgery services.
CONCLUSION: Implementation of the PFC model resulted in an increased demand for clinical pharmacy services in both the pediatric and adult inpatient settings.

304. Cost and clinical impact of pharmacists' consultations. *Steven R. Abel, Pharm.D., FASHP*, Carol W. Birk, M.S.; Purdue University; Clarian Health Partners, Indianapolis, IN.

PURPOSE: This report describes the types of patient-specific consultations which were made by pharmacists practicing in an inpatient setting. The cost and clinical impact of the consultations were assessed.
METHODS: Pharmacists practicing within the inpatient setting documented patient-specific consultations on a pocket-sized documentation form. Each recommendation was reviewed for clinical appropriateness and impact by a pharmacy administrator, based on a published scale. Individual patient records were reviewed to identify the cost impact of the consultations.
RESULTS: From August 1997 through July 1998, 11,960 patient-specific consultations documented by pharmacists were categorized and the cost avoidance or cost savings calculated.

Cost Avoidance Consultations	Number	Annual Cost Impact
Drug allergy/interaction avoidance	662	$254,877
Pharmacokinetic consultation	1100	$158,620
Laboratory tests discontinued	757	$22,657
Adverse drug event avoidance	190	$191,980
Changed dose/dosing schedule	5617	$155,819
Discontinued therapy	2086	$674,931
Therapeutic alternative prescribed	1548	$771,585
Total cost avoidance/savings		$2,230,469

These figures reflect the balance of recommendations which increased and decreased cost. No suggestion was deemed detrimental to patient care. The majority (71%) raised therapy to what would be considered the standard of practice.
CONCLUSION: Our data suggest that patient-specific consultations generated by pharmacists can improve the quality of care while reducing health care costs.

305. Computerized documentation of pharmaceutical interventions and outcomes using IDX Lastword™. *Julie M. Koehler, Pharm.D.*, Christopher J. Urbanski, M.S.; Clarian Health Partners, Inc., Indianapolis, IN.

PURPOSE: To develop an electronic method of documenting pharmacists' interventions which will 1) create a permanent intervention database, and 2) integrate intervention data with patient- and drug-specific data that can be utilized to evaluate outcomes.
METHODS: Documentation of pharmaceutical interventions at Clarian Health is currently a manual process. The existing form, which must be filled out by hand, is utilized to document qualitative interventions and their associated outcomes, which describe the impact of pharmacists' interventions on patient care and cost avoidance. Short-comings of the current method of documentation include 1) the significant amount of time involved in completing the forms and subsequent entering of the data into a computer database, and 2) inability to capture patient- and drug-specific data (e.g., patient demographics, allergies, other medications, drug cost), which could be used to analyze the degree of impact of the intervention. We developed a database using IDX Lastword™, which will allow pharmacists to directly enter qualitative interventions by accessing a patient account number. By utilizing this database, we can capture other data relevant to the intervention and evaluate the data as it relates to outcome.
RESULTS: In progress.
CONCLUSIONS: Through the development of an electronic means of documentation at Clarian Health, we can not only improve the efficiency of the documentation process, but also integrate interventions and outcomes with patient- and drug-specific data. The availability of this data will allow us to better analyze the impact of our interventions.

306. Documenting the value of clinical pharmacy services in a multihospital setting. *Stephen M. Dolley, B.S.*; Medfield State Hospital, Medfield, MA.

PURPOSE: Documenting the value of clinical pharmacy services has been a great challenge to the profession of pharmacy. This report will describe the team efforts of clinical pharmacists providing pharmaceutical care in the Massachusetts state pharmacy system to assign both temporal and monetary values to the services which they provide.
METHODS: A list of interventions, conducted on a regular basis by the team members, was compiled. Each intervention was assigned a monetary value based on potential cost savings. The assigned cost savings were approved by the Massachusetts State Office for Pharmacy Services. Interventions are then logged into the state pharmacy computer system which tracks the intervention on a patient specific basis, as well as the assigned monetary value and the time taken to provide the intervention.
RESULTS: Monthly reports are then generated which support both the temporal and monetary value of clinical pharmacy services. Reporting can be both site-specific and statewide. Patient specific interventions are readily retrievable.

307E. Portable physician profiling system: an application designed to measure changes in prescribing. *Kerri L. Eye, Pharm.D.*, Becky J. Hyland-Marciniak, Pharm.D., Jennifer D. Olstad, Pharm.D.; Prime Therapeutics, Inc., Saint Paul, MN.

Presented at the 33rd Midyear Clinical Meeting of the American Society of Health-System Pharmacists, Las Vegas, NV, December 6-10, 1998.

308. The value of drug information services in a health maintenance organization. *Mohammed R. Hamid, M.S.*, Kerri Chitwood-Dagner, Pharm.D., BCPS; Diversified Pharmaceutical Services, Inc., Edina, MN.

PURPOSE: This analysis is to quantify and demonstrate the value of drug information services (DIS) to a large health maintenance organization (HMO) through a pharmacy benefit manager (PBM).
METHODS: In January 1997, a pharmacist was designated to provide DIS for an 8 million member HMO. The number and type of DI requests, the classification of requesters, and the resources used were tracked for 1 year. A survey was sent to requesters to evaluate their satisfaction and the clinical and financial impact of the responses.
RESULTS: In 1997, 550 DI requests were processed; 71% were generated by the HMO's clinical pharmacy directors and the remaining DIS were provided to other HMO departments and affiliates. The majority of requests (53.5%) were for therapeutic drug use, mostly non-FDA-approved; 23.3% were for product availability. The most common resources were Medline (289), Micromedex (217), and the Internet (112). Eight of 14 requesters responded to the survey. All responders were highly satisfied with the clarity, accuracy, timeliness, and completeness of the DIS. Most requesters indicated that DIS are vital and that they had a considerable clinical and financial impact on their health plans.
CONCLUSIONS: The value of traditional DIS has been well documented. Information demonstrating the value of these services in a PBM or HMO setting is lacking. These data demonstrate the high utilization and unique pattern of request type for PBM/HMO DIS. The high level of non-FDA-approved drug use requests may reflect different prescribing patterns between inpatient and outpatient prescription-drug utilization. The considerable clinical and financial impact of DIS further demonstrates the value of these services.

309. The financial contribution of drug sampling to our community. *Peter G. Koval, Pharm.D.*; Moses Cone Family Practice Center, Greensboro, NC.

PURPOSE: To quantify the amount of samples in our practice and document the financial contribution of samples to our patients' care.
METHODS: The JCAHO requires a system to regulate the use of samples in outpatient facilities associated with health systems which contains specific data on every medication dispensed to an ambulatory patient. We created a system that tracked each sample from the pharmaceutical representative to the patient. Through serendipity, we realized the sample log could also be used as a gauge of financial contribution to patient care by applying prices to the dispensing log.
RESULTS: Once we had a full year of data, we analyzed the sampling experience of our practice. We calculated a price for each drug dispensed based on average wholesale price, the number of times we dispensed samples, and the average price per dispensing. The number of patient clinic visits were also recorded. For the year studied, we provided samples 5732 times and documented $188,823 in medical care. The average price per sample dispensed was more than $32 and increased throughout the year we reviewed. The total contribution to our patients averaged more than $15,000 per month.
CONCLUSION: Physician offices affiliated with health systems must track medication samples to meet JCAHO requirements. A beneficial secondary effect of implementing such a system is that the previously undocumented financial contribution to patient care can be tracked. Our practice serves as a conduit for significant financial contribution from pharmaceutical manufacturer's to our community.

310. Pharmacists as primary care practitioners in a family medicine clinic: a model for establishing services and obtaining reimbursement. *Sarah A. Salzberg, Pharm.D.*, Timothy J. Ives, Pharm.D., M.P.H.; University of North Carolina Hospitals and Clinics, Chapel Hill, NC.

PURPOSE: Pharmacist involvement in primary care clinics continues to expand, but many do not bill nor receive reimbursement for the services they provide.
METHODS: A model for obtaining reimbursement for primary care pharmacists practicing in a family medicine clinic is described.
RESULTS: Several components are necessary to establish primary care pharmacist services and obtain reimbursement. Patients with high risk, high utilization, or high costs associated with their medical care are targeted for pharmacy services. Before seeing patients, clinical staff privileges and an institutional provider code should be obtained, and the charges for various levels of service must be determined. Consultation with practice plan administrators or third party payers provides information on those services they are currently willing to provide reimbursement for. To initiate pharmacist services, a written referral from the patient's primary provider must be obtained. After services have been provided, the intensity, complexity, and content of the patient encounter must be documented in the patient's chart. Next, a claims form must be submitted to the patient's insurer. This activity requires a working knowledge of levels of billing and various billing codes. The scope and quality of the pharmacist's services should be reviewed annually. As the pharmacist's involvement in the clinic progresses, evaluation of therapeutic outcomes and economic impact will help justify the pharmacist's clinical role.
CONCLUSIONS: An increasing number of pharmacists are providing primary care and receiving reimbursement for these services. Knowledge and application of this process in other primary care settings will be a major determinant in assessing its validity and sustainability.

311. A comparison of pharmacy interventions in a specialty versus primary care clinic. *Allen Jan, Pharm.D.*, Nancy M. Waite, Pharm.D., Josephine M. Whitford, Pharm.D., Michael P. Kane, Pharm.D., BCPS; Albany College of Pharmacy; Albany Medical Center; The Endocrine Group, Albany, NY.

PURPOSE: The pharmacist's role in ambulatory care continues to expand. Auditing how this increasing role has benefited patient care will assist in justification of continued expansion of ambulatory care practice. More detailed examination of these outcomes reveals additional layers of information (e.g., specialty versus general practice and physician- versus pharmacist-driven data) that will be helpful in tailoring supportive documentation. The aim of this study was to determine the difference in types and impact of pharmacy interventions in a specialty (endocrinology) versus primary care clinic.
METHODS: Intervention and outcome data was collected at two clinics from January to September 1998. Pharmacy activities, numbers and types of drug-related problems (DRPs), outcomes, clinical significance, and cost issues were recorded.
RESULTS: One thousand seven hundred fourteen clinical workload sheets were collected (471 endocrine; 1243 primary care). Significantly more patients (10.2 vs 8.75, p=0.048) and more DRPs/workup (15.5% vs 24.5%, p= 0.0001) were identified in primary care. DRPs in the endocrine practice were more likely drug interactions or excessive dosing and less likely untreated indications. Acceptance rate of interventions was greater than 90% at both clinics. Patient-specific outcomes were achieved (when documented) with 98% of the DRPs. The majority of interactions were rated as low to moderate impact and either saved or had no effect on cost.
CONCLUSIONS: Investment in pharmacy services in ambulatory clinics results in significant benefits to patients. Explanations for the differences in DRP numbers and profiles may relate to practice philosophies and parameters in specialty versus primary care settings.

312. Impact of a scheduled refill program on health care utilization frequency and costs. *Karen J. Martin, Pharm.D.*, Mahtab Hariri-Salehi, Pharm.D.; University of Toledo, Toledo, OH; University of Illinois at Chicago, Chicago, IL.

PURPOSE: To examine the effects of scheduling refills on the frequency and costs of total health care utilization (HCU) encounters: 1) clinic visits, 2) emergency department (ED) visits, and 3) hospitalizations.
METHODS: This was a retrospective, historically-controlled cohort study conducted in an ambulatory care pharmacy. The Refill 10 (R10) Program was implemented in response to logistical barriers to providing effective pharmaceutical care. Patients taking at least ten chronic medications for at least 6 months were eligible for enrollment and identified by medication profiles and medication histories. After verbally consenting, patients' medications were coordinated for monthly refills. One-month refills were scheduled with their primary care pharmacist on a specific date and time. Refills were generated and filled 2 working days before the refill appointment, and patients were given a telephone reminder. Study endpoints were compared for 1 year prior to and 1 year after enrollment.
RESULTS: Thirty-five patients enrolled into the R10 Program. Annual frequency in total HCU decreased by 0.43 encounters per patient in the R10

group (p=0.41). Annual costs associated with total HCU encounters decreased by $452 per patient (p=0.47). Annual costs associated with ED visits decreased by $224 per patient (p=0.03). Total cost savings for the 35 patients enrolled in the R10 Program was $15,824 annually.
CONCLUSION: Our R10 Program was associated with a decrease in total HCU frequency and costs, and a statistically significant decrease in ER costs. It is an inexpensive and easily implemented program which justifies reimbursement for cognitive services.

313. Implementation of an intravenous immune globulin restriction program in a 923-bed tertiary and primary care teaching facility. Jennifer L. Horan, Pharm.D., Donna Capozzi, Pharm.D., Morton P. Goldman, Pharm.D., FCCP, BCPS, *Mandy C. Leonard, Pharm.D.*, Ana R. Vann, Pharm.D., David A. White, B.S., Brian J. Bolwell, M.D.; Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: To develop and implement a restriction program for intravenous immune globulin (IVIG) use due to its limited supply, economic impact, and increased requests.
METHODS: Using FDA-approved indications and available literature, a committee of Cleveland Clinic Foundation (CCF) physicians and pharmacists developed specific restrictions for IVIG use by defining four tiers based on availability: < 1000, 1000-1500, 1500-2000, and > 2000 grams. As tier levels changed, the pharmacists were notified by the pharmacy computer and the medical staff were notified by electronic mail. When IVIG was ordered, the indication for use was assessed for appropriateness and documented by the pharmacist by computer. If the indication was outside of the restrictions, approval from designated individuals was required. Trends in IVIG use were retrospectively reviewed over a 1-month period following implementation to evaluate the impact of the restrictions.
RESULTS: In September 1998, 1 month following implementation of the guidelines, 47 patients received IVIG. Forty-four (94%) of the 47 patients had appropriate indications based on the specified tier restriction. Pharmacy documentation of IVIG use occurred in 73.8% of the patients and all of these indications met the appropriate restrictions. Indications for IVIG included bone marrow transplantation (53%), chronic lymphocytic leukemia with documented immunodeficiency (13%), multiple myeloma with documented immunodeficiency (9%), immune thrombocytopenic purpura (6%), and others (19%).
CONCLUSION: Implementation of these carefully developed and strictly enforced guidelines ensure the consistent availability of IVIG for patient care at CCF despite worldwide shortage.

314E. The Canadian clinical pharmacy services study. *William M. McLean, Pharm.D., FASHP, FCCP*, Barbara G. Ogle, M.S., Jeffrey W. Poston, Ph.D.; Ottawa Hospital, Ottawa, ON, Canada; Pharmasave Inc.; Canadian Pharmacists Association.

Presented at the Midyear Clinical Meeting of the American Society of Hospital Pharmacists, Atlanta, GA, December 7, 1993.

315. Benchmarking for documentation of pharmaceutical care interventions in a Hispanic hospital with limited resources. *Mirza D. Martinez, Pharm.D.*, Sylvia Galliano, B.S.; University of Puerto Rico, San Juan, Puerto Rico; Caguas Regional Hospital, Caguas, Puerto Rico.

PURPOSE: To examine pharmaceutical care activities and documentation forms to benchmark for the best system to document the value of the service.
METHODS: A continuous quality improvement (CQI) project to benchmark for the best documentation system that relates to key measures of clinical outcomes, patient satisfaction, and costs was initiated. Pharmacists record adverse drug events, drug-related problems (DRP), and educational activities in different forms. The form used to record DRP interventions lists the problems and provides for a brief description, the recommendation made, and follow-up actions taken by the physician. The current available literature on documentation of pharmacist interventions in the inpatient setting was studied and compared to our data. Improvements were initiated.
RESULTS: Current literature recognizes the importance of documentation although systems vary and published studies use different methodology and criteria. The number of interventions varies among institutions. The best systems are computerized, include interventions tied to potential outcomes (i.e., effectiveness, safety, cost avoidance, patient education), and are subject to CQI activities. From 1997-1998, 1836 interventions were manually documented and 1608 were studied and categorized (28% [445] drug order clarifications, 45% [722] changes to formulary drugs, 10% [157] discontinue unnecessary drug). To improve documentation, a computerized system was recommended and the form is being revised. A CQI program is being developed to improve skills (DRP identification and resolution), to empower pharmacists to participate in the implementation of patient care maps, the aminoglycoside dosing protocol, and the medication use process.
CONCLUSION: Ideas to improve were identified and changes in the underlying process were generated. Benchmarking is a valuable strategy to identify best practices.

316. Clinical pharmacy on-call service in a tertiary care hospital. *Janet K. Pitner, Pharm.D., BCPS*; Medical University of South Carolina, Charleston, SC.

PURPOSE: An important step in the advancement of clinical pharmacy, whether for position justification, outcome management, or reimbursement, is the documentation of cognitive services provided. This report describes cognitive services provided by the clinical pharmacy on-call service at the Medical University of South Carolina Hospital, a tertiary care institution.
METHODS: As an extension to daytime coverage, the clinical pharmacy call service operates after business hours at night, on weekends, and holidays to provide 24-hour pharmaceutical care. Pharmacy residents handle call services front line and clinical faculty provide backup. Each pharmacy resident was asked to document cognitive services performed during their on-call period during a 1-year period. Data collected included descriptive information concerning pharmacokinetic drug monitoring performed and queries for drug information.
RESULTS: Data were evaluable for 42 weeks of service. Two hundred fifty-nine patients with 288 drugs were monitored, and 117 questions were fielded. Questions were asked by physicians (70), pharmacists (33), and nurses (9). The most common information requests were for drug dosing (50), therapeutic drug use (25), and nutritional assistance (11). Twenty-eight hospital areas used the service including the intensive care units (MICU, CCU, CTICU, NICU, STICU); medicine specialties (cardiology, hematology/oncology, infectious diseases, family medicine, nephrology, internal medicine, pulmonary, gastrointestinal, urology, obstetrics, dermatology, ENT); surgery (neurology, CT, general, oral); transplant (renal, liver); pediatrics; and psychiatry.
CONCLUSION: This service was widely used by physicians in our hospital. To achieve recognition, acceptance, manage outcomes, and be reimbursed for cognitive pharmacy services, these services must be documented.

317. Patient compliance and blood pressure control onboard a nuclear powered aircraft carrier: impact of an onboard pharmacy officer. *Mark E. Brouker, Pharm.D., MBA, BCPS*, E. Paul Larrat, Ph.D., Robert L. Dufresne, Ph.D., BCPS; University of Rhode Island.

PURPOSE: In an attempt to measure the impact of a pharmacy officer on patient compliance and intermediate clinical outcomes while onboard a deployed nuclear powered aircraft carrier (approximately 6000 crew members), a pharmacy officer was assigned to the *USS John C. Stennis* (*JCS*) throughout a 2-week at sea period.
METHODS: Prior to any counseling by a pharmacy officer, crew members on chronic medications onboard the *USS JCS* were asked to complete an anonymous compliance questionnaire (n=43). These crew members were then counseled by the pharmacy officer as to the importance of compliance. Approximately 2 weeks after completion of the pre-counseling questionnaire, a follow-up compliance questionnaire was given to these same crew members.
RESULTS: Post-counseling compliance increased 58% (p<0.0001) from compliance measured pre-counseling. The pharmacy officer also initiated, with approval of a medical officer, therapeutic interventions. Before any pharmacy officer-initiated therapeutic interventions were instated, blood pressure (BP) measurements were taken on crew members diagnosed with hypertension (n=26). At least 10 days after the initial BP measurement and after any subsequent pharmacy officer-initiated therapeutic interventions, BP measurements were taken on these same hypertensive crew members. Post-intervention, 31% (p<0.02) more crew members were at BP goal as compared to pre-intervention results. CONCLUSION: During a 2-week at sea period, a pharmacy officer improved intermediate clinical outcomes and patient compliance while onboard a deployed nuclear powered aircraft carrier. Further study is needed to measure the full impact on clinical, economic, and humanistic outcomes of a pharmacy officer onboard these vessels.

318. The association between clinical pharmacy services and mortality rates in United States hospitals. *C.A. Bond, Pharm.D., FASHP, FCCP*, Cynthia L. Raehl, Pharm.D., Todd Franke, Ph.D.; Texas Tech University, Amarillo, TX; University of California, Los Angeles, CA.

PURPOSE: Over the last 25 years, substantial literature has shown that pharmaceutical services can improve the quality of care and in some cases reduce costs. A literature search from 1966-1998 found only one study which showed that a pharmacist provided service, drug information, was associated with reduced mortality rates (Pharmacotherapy 14:620-30).
METHODS: The Medicare Hospital Mortality Information data tape for 1992 was purchased from the Health Care Financing Administration for individual hospital mortality rates. Thirteen hospital-based clinical pharmacy services from the 1992 National Clinical Pharmacy Services Study (Pharmacotherapy 1994;14:282-304) served as independent variables in this study. A multivariate stepwise regression model adjusting mortality rates for severity of illness was utilized.
RESULTS: A total of 1028 hospitals were able to be matched from these two data bases (21% of all U.S. hospitals). The presence of four clinical pharmacy services was associated with reduced hospital mortality rates: clinical research (slope = -0.008457, p<0.0001), drug histories (slope = -0.006009, p<0.005), cardiopulmonary resuscitation team membership (slope = -0.002187, p<0.05), and drug information (slope = -0.002186, p<0.05), r^2=0.224.
CONCLUSIONS: This is the first study that demonstrates both patient-

specific and centrally based clinical pharmacy services are associated with reduced hospital mortality rates.

Psychiatry

319E. Pharmacist designed and implemented pharmaceutical care plan for antipsychotic-induced movement disorders. *Steven C. Stoner, Pharm.D., BCPP*, Jodi A. Worrel, Pharm.D., Michael T. Jones, Pharm.D.; University of Missouri-Kansas City, Kansas City, MO; Northwest Missouri Psychiatric Rehabilitation Center, St. Joseph, MO.

Presented at the Annual Meeting of the American Pharmacutical Association, San Antonio, TX, March 5-9, 1999.

320. Primary care in persons with developmental disabilities: impact of a board certified psychiatric pharmacist. *William H. Benefield, Jr., Pharm.D., FASCP, BCPP*, Sharon Tramonte, Pharm.D.; University of Texas at Austin; Austin, TX; The University of Texas Health Science Center at San Antonio; San Antonio State School, San Antonio, Texas.

A board certified psychiatric pharmacist performs drug therapy management under protocol at a 320-bed ICF-MR facility for the developmentally disabled since 1995. The protocol serves as the standing delegation order by the physicians of the facility for the pharmacist to perform all necessary activities related to drug therapy management. The protocol includes qualifications of the prescribers, scope of the pharmacist's prescriptive authority, and the pharmacist's clinical privileges for drug therapy management.
The pharmacist has the following clinical privileges: 1) perform physical and mental examinations for monitoring drug-induced response and adverse reactions; 2) order, obtain, and interpret medical data (e.g., labs, ECG) as necessary for drug monitoring; 3) order new, adjust, or discontinue current psychotropic and anticonvulsant medication for the management of any documented DSM IV diagnosis, maladaptive behavior, or seizure disorder; 4) order new, adjust, or discontinue current medication as clinically needed to manage drug-induced side or adverse effect; 5) manage acute agitation with appropriate pharmacotherapy; and 6) provide primary psychiatric care to patients through rounds, on-call coverage, and monthly interdisciplinary meetings.
The innovative prescribing protocol and its impact on improving patient care and lowering cost at our facility is described. Results from physician peer reviews and physician satisfaction surveys will be presented. Cost savings of approximately $45,000 per year in psychiatrist services have been achieved. Documented positive outcome measures also include appropriate drug monitoring, an overall decrease in chlorpromazine equivalents, patient stabilization, and continuity of care. Qualitative and quantitative data will be presented to support the impact of this progressive practice.

Pulmonary

321. A comprehensive asthma program in an outpatient pharmacy setting. Julie A. DeCamp Palmer, Pharm.D., Theresa O'Young, Pharm.D., *Cindi Brennan, Pharm.D.*; University of Washington Medical Center; Harborview Medical Center, Seattle, WA.

PURPOSE: 1) Implement a comprehensive pharmacist-directed patient education and monitoring program in an inner city, county hospital outpatient pharmacy serving a low income, underserved population. 2) Compare the number of emergency room visits, hospitalizations, and asthma self-care behavior before and after patients participate in this program. An intervention document will serve as the communication between outpatient pharmacists and clinic providers.
METHODS: A standardized monitoring form for asthma self-care behavior that includes basic asthma knowledge; symptom and exacerbation evaluation; trigger control; pharmacotherapy assessment, including inhaler and peak flow meter technique; and quality of life measures will be developed and utilized. All patients are referred for pharmacist intervention at the time of their monthly asthma medication refill in the outpatient pharmacy. Asthma patients in our health-system's full-risk managed care population at highest risk for repeated emergency room visits due to acute asthma exacerbations will be identified. The monitoring form and recommendations will be forwarded to patient's clinic provider.
RESULTS: Enhancing asthma self-care behavior, especially for patients at high-risk, and communication with clinic providers may lead to decreased emergency room visits and hospitalizations, resulting in cost avoidance for patients and managed care health plans.
CONCLUSIONS: Ambulatory care pharmacists are ideally situated to provide individualized patient education and monitoring for chronic conditions, as educational visits can be coordinated with patients' monthly medication refills. Reinforcement of appropriate asthma self-care behavior can lead to improved patient outcomes and cost avoidance for health care systems. Results will be used to support payment to pharmacists for cognitive services.

Rheumatology

322. The pharmacist's contribution in the rheumatological health care team. *Kirsten K.Viktil, pharmacy candidate*; Diakonhjemmets Sykehusapotek, Oslo, Norway.

At the rheumatology department at the Diakonhjemmets Hospital, Oslo, a pharmaceutical service was established 3 years ago with a pharmacist joining the health care team on a regular basis. Clinical pharmacists optimizing the individual patient's drug therapy does not have a long tradition in most Norway hospitals; therefore, it is important to document the pharmacist's contribution in the health care team.
In addition to the contribution of the pharmacist at morning meetings where individual patient's drug regimens were discussed, the chief physician and the pharmacist agreed that information by the pharmacist to this group of chronically ill patients about specific antirheumatic drugs (methotrexate, sulfasalazine, hydroxychloroquin, cyclosporine A, natriunaurothiomaleat, chlorambucil, and azathioprine) would improve the individual patient's drug therapy. When a patient at the ward was to commence with an antirheumatic drug, the pharmacist was requested by the physicians to give information about the drug. At the outpatient clinic, the patient was similarly referred to the pharmacist by the physicians.
On the ward, the pharmacist documented in the medication chart when information had been given. At the outpatient clinic, the pharmacist wrote a short summary in the patient's journal. A quantification of this drug information has been made. Physicians, nurses, and patients have stated their satisfaction with the usefulness of this drug information with regard to both the quality of drug information and the time saved for the other health professionals.

Transplantation

323. Documentation and analysis of pharmaceutical care provided by clinical pharmacists on the inpatient kidney and liver transplant services. *David J. Quan, Pharm.D.*, Ivy Lee, Pharm.D., BCPS; UCSF Medical Center; UCSF Stanford Health Care, San Francisco, CA.

PURPOSE: The purpose of this study is to quantify and describe the pharmaceutical care provided by clinical pharmacists on the inpatient kidney and liver transplant services in a university hospital setting.
METHODS: Clinical interactions by clinical pharmacists on the kidney and liver transplant service were documented over eight consecutive months. The interventions were divided into six categories: 1) decrease drug cost, 2) optimize therapy, 3) educational, 4) patient satisfaction, 5) revenue generating, and 6) reimbursement. Each category was also subdivided further, which better described the type of interaction. Each interaction was also graded based on the level of significance as described by Hatoum, et al. Direct drug cost saved, if applicable, was calculated.
RESULTS: A total of 1757 clinical interactions were made over an 8-month period between two clinical pharmacists. Approximately 13% of interactions involved decreasing drug cost, 52% involved optimization of drug therapy, 3% were educational, 27% patient satisfaction, 3% revenue generating, and 2% involved insurance reimbursement. Over 87% of interactions were at a level of significant or greater. Direct drug cost saved was in excess of $14,000.
CONCLUSIONS: The documentation of clinical interactions over an 8-month period has allowed us to describe and quantify the pharmaceutical care that is provided by clinical pharmacists on the inpatient kidney and liver transplant services at UCSF. The clinical pharmacist plays an important role on the transplant services. A majority of interactions involve optimization therapy, decreasing drug costs, and providing direct patient care services.

CLINICAL PHARMACY PROGRAMS

These papers describe innovative clinical pharmacy practice, education, research, and training programs in various countries; they may be descriptive only and need not contain an evaluative component.

324. Clinical pharmacy research and practice in a small hospital. *Joseph A. Paladino, Pharm.D.*, Gabrial S. Zimmer, Pharm.D., Katherine E. Welch, Pharm.D., Linda D. Dresser, Pharm.D., Jerome J. Schentag, Pharm.D.; Millard Fillmore Suburban Hospital, Buffalo, NY.

PURPOSE: Clinical pharmacy services are at least as important in small community hospitals as in large, university-affiliated tertiary care institutions. This study evaluated the clinical and economic impact of a clinical pharmacy program in a small community hospital.
METHODS: A 188-bed suburban hospital is the practice site for two clinical pharmacists specializing in infectious diseases, pharmacokinetics, and pharmacoeconomics, and two post-Pharm.D. fellows. Data obtained from monthly administrative reports documenting the clinical and economic

impact of the daily provision of clinical pharmacy services and phase II-IV clinical research were analyzed. Intervention categories include: pharmacokinetic monitoring; initiation, change, or discontinuation of drug therapy; conversion from intravenous to oral administration; patient enrollment into clinical studies; and miscellaneous intercessions. Clinical outcomes were categorized as success, transfer, or death. Economic assessment included the following costs: drug acquisition, preparation and administration (P&A), therapeutic drug monitoring (TDM), and length of stay (LOS).
RESULTS: During the last year, 686 patients were seen in consultation and 1190 clinical interventions were made. Historically, more than 90% of recommendations are accepted. More than 87% of patients had a successful clinical outcome. The following net savings were conservatively documented: drug acquisition $49,637; P&A $29,672; TDM and other laboratory tests $39,442; and LOS $52,200. These savings to the institution totaled $170,951. Staff salaries were funded by research grants and were not included in the analysis, although this is an additional economic benefit.
CONCLUSIONS: Ample opportunity for a fulfilling career exists in small hospitals. Medical personnel and hospital staff rely on clinical pharmacists, while the institution realizes economic benefits.

325. A collaborative approach to improving adverse drug reaction reporting. *Grant E. Sklar, Pharm.D., BCPS*; Sotiria Tragoulia, B.S.N.; King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia

Adverse drug reactions (ADRs) are reported to occur in up to 30% of hospitalized patients. In 1996, at King Faisal Specialist Hospital and Research Center, a 550-bed, tertiary care hospital averaging 20,000 admissions per year, 54 ADRs (0.27% of admissions) were reported by hospital staff. In mid-1997, the departments of pharmacy and quality assurance began a collaborative approach to increase awareness of ADRs and to improve reporting of ADRs. Multiple steps were undertaken, including: 1) distribution of ADR reporting forms to inpatient nursing units and outpatient clinics; 2) reminders published in the pharmacy newsletter about reporting ADRs; 3) in-services to nursing staff and physicians regarding the importance of reporting ADRs and how to report ADRs; 4) posters at inpatient and outpatient nursing units reminding staff to report ADRs; and 5) reports obtained from medical records based on ICD-9 codes for ADRs. In 1997, 135 ADRs (0.68% of admissions) were reported. In the first 6 months of 1998, 130 ADRs (1.3% of admissions) were reported. Based on increased reporting of ADRs, trends have been identified for several drugs (e.g., vancomycin and intravenous immune globulin) which have resulted in changes in pharmacy procedures and education of hospital staff to try to prevent these ADRs. As a result of this collaborative effort, we have seen a significant increase (approximately 5-fold over 1996) in ADR reporting.

326. Adverse drug reactions monitoring in the Republic of Georgia. *Zaza Chapichadze, M.D., Ph.D.*, Bondo Kobulia, M.D., FESC, Irina Jashi, M.D., Ph.D., Tamara Chelidze, M.D.; Drug Monitoring National Center of Pharmacovigilance, Tbilisi, Republic of Georgia.

According to Georgian drug law and the order of the Minister of Health, the Pharmacovigilance Program was set up in the Republic of Georgia to monitor the safety of medicinal products, register spontaneous reporting by health officials, study prescription practice in clinics and outpatients and drug consumption in pharmacies, and publish this information.
Recent political, economic, and social changes have created a transitional period in Georgia and have had a great impact on the health care system. At the same time, when there are so many drugs of Eastern production on our market that must be characterized as unnecessary, confusing, or sometimes illogical, one must realize that in our country large segments of the population still do not have access to efficacious, safe, and inexpensive drugs. On the other side, a rapid introduction of thousands of Western products for therapeutic use, after the collapse of separate Eastern markets, has confused our doctors. Doctors and pharmacists are confronted with many drugs that they have not been taught to use. It has become clear that Georgia needs to address a program of safe and rational drug use due to the magnitude of the problem and medical and public concern about it.
The results of our 12-month adverse drug reaction monitoring revealed the benefit of more expensive drugs (Western products produced according to GMP standards), taking into consideration the price of course therapy, prevalence of adverse drug reactions, duration of treatment, daily dosage, concomitant therapy, additional analysis, quality of life, and compliance.

327. Development and implementation of a pharmacist-coordinated cancer pain program. *Suzanne Amato Nesbit, Pharm.D., BCPS*; Akron General Medical Center, Akron, OH.

PURPOSE: To provide a patient-centered pain management program that actively assesses and optimally treats cancer patients' pain and effectively manages their side effects. The program is coordinated by a Pharm.D.-trained practitioner.
METHODS: The program manages both inpatients and outpatients. The cancer pain program operates as a consult service for inpatients with follow up in the outpatient setting. Outpatients are referred by physicians or by the nursing staff in the outpatient treatment center. Patients are seen and assessed by the coordinator of the program. Detailed histories of their pain and medications are taken. Charts are reviewed to assess their medical history and review any diagnostic procedures that may have been done. Patients are asked to rate their pain on a scale of 0 to 10. After the patient is assessed, recommendations are made to the physician regarding pain and side effect management. Patients are followed in person or by telephone for efficacy and toxicity. If other modalities of pain management, such as anesthesia, physical therapy, acupuncture, or complementary therapies are needed, the coordinator facilitates those referrals. In 1996, the first full year of operation, 154 patients were evaluated and managed by the cancer pain program. In 1997, 126 new patients were referred to the program, in addition to ongoing management of patients previously referred. Education of patients, nursing, and medical staff is also a key responsibility of the coordinator. Pocket cancer pain management guidelines were developed for staff. An assessment and documentation tool was also developed.
CONCLUSIONS: A pharmacist-coordinated cancer pain program is described. Specific patient outcomes measurements need to be developed to assess the impact on patients' pain management and quality of life.

328. Development of the pain resource professional training program. *Virginia L. Glen, Pharm.D.*, Margaret S. Wacker, B.S.N, Ph.D.; University of Rhode Island; Rhode Island Hospital, Providence, RI.

PURPOSE: This program has been developed as the education foundation for teaching physicians, pharmacists, nurses, and other patient care providers different approaches employed in the treatment of pain. The goal is to train health care professionals to improve their practice of pain management and serve as a knowledgeable resource for colleagues, patients, and their family members.
METHODS: The pain resource professional (PRP) program instructional methods consist of didactic lectures and hands-on skills workshops taught by pain management experts during the 5-day course. Major course topics include anatomy and physiology of acute versus chronic pain, pain assessment, pharmacologic treatment, complimentary therapies, special populations (pediatrics and elderly), ethical and spiritual issues, and procedural treatment involving interventional anesthesiology, neurosurgery, and radiation. The progress of the participants is assessed through the administration of a pre-test at the beginning of the program and post-test upon completion of all the course sessions. Continuing education credit is approved by the Rhode Island Medical Society, Rhode Island State Nurses Association, and American Council on Pharmaceutical Education.
RESULTS: Thirty health care professionals participated in the first offering of the PRP program in October 1998. Evaluation of the program was documented each day on a form that asked participants to rate the achievement of course goals, effectiveness of the instructor, teaching methods, and room facilities. Results from the first session are currently in review.
CONCLUSIONS: Participants will be required to attend regular pain meetings upon completion of the program to maintain their PRP status. This program offers a unique opportunity to provide continuous multidisciplinary education in pain management to health care professionals.

329. Evaluation of the impact of a pharmacist-led intervention program on physician adherence with secondary prevention NCEP guidelines. *Joli D. Cerveny, Pharm.D., BCPS*, Stacy M. Prutting, Pharm.D., Nanette C. Bultemeier, Pharm.D.; Medical University of South Carolina, Charleston, SC.

PURPOSE: To evaluate adherence with NCEP guidelines, identify physician-reported barriers to adherence with the guidelines, and assess the impact of a pharmacist-led interdisciplinary intervention program. The setting is a university-based internal medicine clinic.
METHODS: Secondary prevention patients were identified by ICD-9 codes for atherosclerotic vascular disease. A 12-month retrospective chart analysis was conducted and repeated 6 months post-intervention. Data collected included secondary prevention diagnoses, frequency of lipid panel (LP) monitoring, LDL-C, and dyslipidemia pharmacotherapy. The 12-month pre-intervention data were analyzed, presented to providers, and improvement strategies were discussed. Patients requiring intervention were flagged in the computerized medical record. A letter summarizing the results and a survey identifying patients' barriers to adherence were distributed to physicians.
RESULTS: Of 94 patients identified, 28% were at goal. Fifty-seven percent of patients had a LP during the pre-intervention phase, of which 48% were at goal. Of the 67% of patients who had been prescribed lipid-lowering therapy, 41% were at goal. At 6 months post-intervention, 36% of patients previously not at goal had a LP. Four patients were started on lipid-lowering agents and three had dosage increases. Two patients reached goal. Patient nonadherence with follow up was the most common reason patients were not having routine LPs or were not at goal.
CONCLUSION: Patients with more frequent LPs were more likely to reach goal. More aggressive lipid- lowering therapy and follow up is necessary for patients to reach goal. Although interdisciplinary intervention had some impact on improved adherence with NCEP guidelines, additional interventions should be pursued.

330. Development and implementation of a pharmacy-based lipid management program in a health maintenance organization. *Lisanne DiTusa, Pharm.D.*, Aileen Bown Luzier, Pharm.D., Gary Brady, B.S., Jim Notaro, B.S., Brian Snyder, M.D.; Health Care Plan, West Seneca, NY; State University of New York at Buffalo, Buffalo, NY.

PURPOSE: We developed a pharmacist-based lipid management program, within a health maintenance organization, to expand pharmacy services in the ambulatory setting and ensure optimal management of patients with hypercholesterolemia.
PATIENT POPULATION: A target population of 3800 patients with documented coronary artery disease were identified, mean age 68 ± 12 years; 60% male. Baseline analysis found that 30% of patients were being treated with lipid-lowering therapy and of these only 19% were at target cholesterol levels.
METHODS: Comprehensive treatment guidelines were developed to guide pharmacists in the assessment, management, and monitoring of patients with dyslipidemias. Patient demographic information, laboratory, and medication profiles were collected from clinical records. A risk assessment is completed on each patient using a standard risk profile model. During routine counseling sessions, the pharmacist evaluates patient compliance with drug therapy, provides diet education, documents adverse effects, and reviews laboratory data with the patient. Therapy recommendations are made based on the treatment protocols. With physician approval, the pharmacist implements the changes in drug therapy and ensures appropriate laboratory follow up. All interventions are recorded in a database for outcome analysis.
CONCLUSIONS: Details concerning the development of treatment protocols and implementation of the program will be presented as well as clinical data and pharmacist intervention for patients enrolled in the program. Performance of the program will be assessed through the number of patients reaching target lipid levels, the associated costs, and improvements in compliance.

331E. Impact on the quality of life of heart failure patients through education and support. Gild M. Saul, B.S.N., *Carla A. Luque, Pharm.D.*, Madeleine M. Burke, B.S.N.; Mount Sinai Medical Center, Miami Beach, FL; Nova Southeastern University, Ft. Lauderdale, FL.

Presented at the Heart Failure Society of America 2nd Annual Scientific Meeting, Boca Raton, FL, September 1998.

332E. Assessment of new onset post-coronary artery bypass surgery atrial fibrillation: current practice pattern review and development of treatment guidelines. Ann E. Thompson, B.S., *Glen J. Pearson, Pharm.D.*, Greg Hirsch, M.D., FRCPC; Queen Elizabeth II Health Sciences Centre; Dalhousie University, Halifax, NS, Canada.

Presented at the Canadian Society of Hospital Pharmacists Professional Practice Conference; Toronto, ON, Canada, February 1-4, 1999.

333. The pathophysiologic approach to arrhythmia treatment: the experience of application in Kazakhstan. Denis Vladimirovich Vinnikov, *Sergey Nikolayevich Victorenko*; South Kazakhstan State Medical Academy, Al Faraby, Kazakhstan.

Created by a group of experimenters and clinicians, the Sicilian Gambit is a pathophysiologic approach (PA) that enables us to arrange and associate antiarrhythmic drug choices with the stated arrhythmia origination mechanism.
PURPOSE: To optimize arrhythmia treatment based on the PA in Southern Kazakhstan.
METHODS: Training practitioners to apply the PA in arrhythmia treatment included demonstrating the theoretic basis of the approach and conducting seminars using computer instruction programs. The comparative efficiency of arrhythmia treatment by the physicians trained in Chimkent hospitals was analyzed. The drug efficiency was estimated after the first dose acceptance and on days 7-10 of treatment by means of ECG and transesophageal cardiac pacing.
RESULTS: We have adapted the PA and created methodical recommendations for physicians with regard to using it. Fifteen practitioners have been taught the PA. For example, the comparative efficiency of the β_1-adrenoblocking agent metoprolol, administered using both empiric dosing and PA has been estimated in 30 patients with tachyarrhythmias (sinus tachycardia and ventricular tachycardia). The daily metoprolol dose was 100-150 mg. PA has enabled an increase of 20-30% in the efficiency of patient treatment, with a decrease in the frequency of side effects during drug selection.
CONCLUSION: Physicians trained to apply the PA enhances arrhythmia treatment efficiency. This example with metoprolol fortifies how PA provides scientific support for the drug choice for tachyarrhythmia patients.

334. Evaluation of the level of control of dyslipidemia patients enrolled in a Veterans Administration medical center. *Annika Barrows, Pharm.D.*, William Linn, Pharm.D.; South Texas Veterans Health Care Systems; Audie L. Murphy Memorial Veterans Hospital, San Antonio, TX.

PURPOSE: This study evaluated the level of LDL control of dyslipidemic patients enrolled at a VA medical center approximately one year after implementing lipid clinical practice guidelines.
METHODS: We reviewed the records of 121 patients (men, ages 42-78 years) receiving either simvastatin or atorvastatin. Adequate control was defined as a NCEP goal for LDL less than 130 mg/dl and 100 mg/dl) for high-risk primary and secondary prevention, respectively.
RESULTS: Ninety patients were being treated for secondary prevention. Of these, 66 were treated with simvastatin up to 20 mg and 24 were treated with atorvastatin 10 mg. In the simvastatin group, 37 patients (56%) reached goal. In the atorvastatin group, 15 patients (63%) reached goal. There were 31 patients treated for high-risk primary prevention; 25 in the simvastatin group and 4 in the atorvastatin group. Seventeen of the 25 simvastatin patients (68%) reached goal and three of the four atorvastatin patients (75%) reached goal.
CONCLUSION: A higher percentage of patients taking atorvastatin 10 mg reached NCEP goal than patients taking up to 20 mg of simvastatin. These data are consistent with recent randomized controlled trials showing that the entry dose of atorvastatin is more effective in achieving NCEP LDL goals than other agents (Am J Cardiol 1998;81:582-7, Am J Cardiol 1997; 80:39-44). The number of patients whose dyslipidemia is controlled falls short of the Veterans Administration national standard of 90%. Additional studies need to be done to evaluate the cost-effectiveness of high dose simvastatin versus atorvastatin.

335. Innovative post-doctoral industrial clinical pharmacy fellowship programs. *Joseph A. Barone, Pharm.D., FCCP*, James T. Rawls, Pharm.D., John L. Colaizzi, Ph.D.; Rutgers University, Piscataway, NJ.

In 1985, Rutgers University initiated several post-Pharm.D. industrial clinical pharmacy fellowships with Hoffmann-La Roche and Warner Lambert/Parke-Davis. The original class consisted of two fellows. The program now has affiliations with other multinational companies, including Novartis, Bristol-Myers Squibb, and Ortho-McNeil. By 1996, 56 fellows had completed the program. There are currently 26 individuals enrolled.
Fellowship objectives are: 1) to provide an understanding of clinical research and other areas through practical experience, 2) to expand clinical knowledge through both industrial and academic endeavors, 3) to promote the role and value of clinically educated pharmacists within the industry, and 4) to provide exposure to a wide array of employment opportunities.
The fellowships have two distinct components. One component occurs at sponsoring companies which share a commitment to involving fellows in the development of innovative products. Fellows may design, implement, and monitor clinical trials (domestically and internationally), and present information at investigators meetings. Fellows interact with various corporate divisions thereby ensuring exposure to the entire clinical development process.
The other component involves Rutgers University. Fellows receive an adjunct faculty appointment and are responsible for teaching and coordinating classes. Fellows can complete a 3-month practice or research rotation, participate in faculty research, and are encouraged to publish. Each fellow gives one formal presentation per year and participates in a bi-weekly seminar series at Rutgers.
Former fellows hold positions at the FDA, independent contract research organizations, various national and global pharmaceutical companies, as well as related pharmacy careers. Many have risen to positions such as director, vice-president, and president.
In conclusion, these fellowships allow individuals to identify a specific area of interest within the pharmaceutical industry which enhances their clinical pharmacy skills. It has been our observation that the program has promoted the value of clinically educated pharmacists within the pharmaceutical industry. Since some fellows have trained overseas and others are working outside the U.S., the fellowship program has demonstrated international applicability.

336. Techniques for improving the quality and effectiveness of education and training in the areas of pharmacoeconomics and outcomes research. *Lorne E. Baskin, Pharm.D.*; Butler University, Indianapolis, IN.

Outcomes research and pharmacoeconomics have become increasingly important as tools to justify the existence of clinical services and select cost-effective medications and procedures. However, one of the rate-limiting steps which prevents more and better outcomes research from being conducted is the limited knowledge and practical experience of clinicians in designing, performing, and analyzing outcomes research. The desirable outcome from training is a measure of the extent to which the participant learns the material and can use the techniques in real settings. Appropriately designed training programs need to recognize: 1) the limits of time available for practitioners, 2) the need for practical experience in designing studies and collecting data, 3) the lack of university training most clinicians receive in these areas, 4) the need to focus on case-based approaches rather than rote memorization, and 5) the opportunity for integration of this material into practical settings. This presentation provides some innovative ideas and plans for improving the quality and effectiveness of training in outcomes research to practicing graduates of health care schools. It shows educators how clinicians can

integrate their knowledge of clinical activities into outcomes research projects. It also shows the importance of using a case-based approach combined with real numerical examples and limited supplemental readings. Finally, a model curriculum is provided, together with reference sources, to guide others who want to implement some of these ideas into educational programs.

337. Medical imaging: an underdeveloped area of pharmacy practice. Description of an approach to educational and clinical services. *Edward M. Bednarczyk, Pharm.D.*, Robert Ackerhalt, Ph.D., Daniel Guarasci, B.S., Gene D. Morse, Pharm.D.; State University of New York at Buffalo, Buffalo, NY.

PURPOSE: Nuclear medicine was among the first areas of specialty practice identified for pharmacy. In spite of this, the pharmacist's role has largely been limited to dispensing radiopharmaceuticals and record keeping. With millions of patients undergoing diagnostic imaging tests annually, it is disturbing that most pharmacists are unfamiliar with this technology. Patients routinely receive does of diagnostic radiopharmaceuticals or contrast media, yet most pharmacists are unaware of these drugs, and have little understanding of how therapeutic pharmaceuticals can interact with these diagnostic compounds, potentially leading to misdiagnosis.
METHODS: We have undertaken a systematic approach to providing pharmacists the skills they need to be knowledgeable in this practice are. Our approach includes establishment of clinical and research services to a department of nuclear medicine, introduction of medical imaging as a portion of the core curriculum of a doctor of pharmacy program, initiation of an elective rotation in medical imaging, and provision of continuing education programs for graduate pharmacists. A nuclear pharmacy residency program, including dispensing and clinical experiences, is under development.
RESULTS/CONCLUSIONS: Medical imaging routinely uses pharmaceuticals as part of the diagnostic process. It is unacceptable for pharmacists to remain unaware of these drugs, their implications, and potential interactions with therapeutically administered drugs. We describe an aggressive program for providing pharmacy education in this area.

338E. Reducing medication administration errors through a program of education and assessment. *Gillian F. Cavell, M.S., M.R.Pharm.S.*, Monica McSharry, B.S.N., M.H.M., Anne Dalzell, B.S.N.; King's Healthcare NHS Trust, London, United Kingdom.

Presented at the United Kingdom Clinical Pharmacy Association, Residential Symposium, Hinckley, Leicester, November 1998.

339. Development and delivery of a community pharmaceutical care residency program: two years experience. *Jay D. Currie, Pharm.D.*, William A. Miller, M.S., Pharm.D., Randal P. McDonough, M.S.; University of Iowa, Iowa City, IA.

PURPOSE: Residency programs are an established method of developing advanced practitioners as well as leaders in pharmacy practice. Doctor of pharmacy graduates seeking to advance their clinical skills in community practice have had limited opportunities for training. Residency programs are necessary to prepare pharmacists to implement or advance clinical practice in the community setting.
METHODS: This residency intends to develop specialty practitioners, develop leaders in the pharmaceutical care movement, and fill a void in the rapidly evolving area of community pharmacy practice. The residency is a collaboration with progressive, pharmaceutical care providing community practitioners. The overall goal of the residency is to train pharmacists to provide direct patient care in the community pharmacy setting. Development of personal and professional leadership skills to advance pharmacy practice, and completion of a project to measure the resident's impact on the practice and on the health of the patients, are the other primary goals of the residency. Residents are also involved with pharmacist and student education. Detailed objectives and description of the residency will be provided.
RESULTS: The program grew from one resident in two sites, to four residents in five sites from 1997 to 1998, respectively. The two 1997 sites each have a resident in 1998. The majority of residency funding is provided by the practice sites.
CONCLUSIONS: The program is successful based on growing interest from pharmacy graduates and support by community practice sites. Objectives of the residency program can be meet with collaboration between academia and practice.

340. Delivery of a community pharmaceutical care clinical clerkship: four years experience. *Jay D. Currie, Pharm.D.*, Randal P. McDonough, M.S., William A. Miller, M.S., Pharm.D.; University of Iowa, Iowa City, IA.

PURPOSE: Changes in health care have resulted in increased emphasis on primary and ambulatory care. Pharmaceutical care practices in community pharmacies are developing to take advantage of new opportunities in patient care. Colleges of pharmacy must provide students the opportunity to train in these sites as preparation for practice.
METHODS: As part of a primary care-focused, entry-level doctor of pharmacy program, a community pharmaceutical care clerkship was developed. Training sites were developed in community pharmacies across the state, matching the training needs of the college. Students on the off-campus 5-week experience provide direct patient care and assist in ongoing development at the site. Faculty make on-site visits twice for case presentations and journal article review. Students provide and discuss case presentations with faculty two additional times via a statewide interactive video network. Adjunct faculty provide daily supervision of the students at each clerkship site. Drug information support is made available to the students via the World Wide Web. Students on their second rotation complete a project to benefit the site.
RESULTS: Twenty-three sites have delivered the clerkship during the last 4 years. The rotation is currently required for two cycles per student and was offered for 142 student cycles this year.
CONCLUSIONS: Collaboration with progressive community pharmacy practitioners enabled the development of a high quality clinical clerkship in the community pharmacy setting. Completion of the community pharmaceutical care clerkship has increased the community practice expectations of pharmacy graduates and improved the level of practice in participating sites.

341. An innovative longitudinal ambulatory care experience for Pharm.D. students. *Ruth E. Emptage, Pharm.D.*, Martin R. Giannamore, Pharm.D.; The Ohio State University, Columbus, OH.

In an effort to provide students long-term exposure to the management of chronic diseases, a year-long experience in ambulatory care was created for Doctor of Pharmacy students. During the clinical experiential year of the Pharm.D. program, the students participating in the longitudinal ambulatory care (LAC) experience attended an adult internal medicine clinic 4 hours a week for approximately 50 weeks. During clinic time the students were involved in co-managing patients with chronic diseases. The format of the experience was integrated into the existing eight 6-week rotations.
In the first year of offering the LAC experience, nine students in a class of 19 elected to participate. After completing 9 months of the experience, a survey of participating students was conducted. Eight out of the nine students suggested continuing to offering the LAC experience for the 1998-99 academic year. Two students commented that the experience was looked upon very favorably by prospective employers. In general, the students felt the format of the experience had fulfilled the goal of increasing exposure to the management of chronic diseases. In the current Pharm.D. class, eight out of nine students elected to participate in the LAC experience.

342. Integrated approach to pharmacy practice experiences (shadow) and career pathways for first professional year students. *Karl D. Fiebelkorn, MBA*, Kris A. Jordan, A.A.S.; State University of New York at Buffalo, Buffalo, NY.

PURPOSE: To introduce the first professional year (P1) pharmacy student to ambulatory and inpatient practice settings early in the curriculum and facilitate individual decisions regarding pharmacy practice track selection within the entry-level Doctor of Pharmacy program. To provide the P1 student active learning in a transitional experience setting; to provide initial developmental practice skills, attitude, and professionalism; and to prepare them for the advanced pharmacy experience program (PEP) in P4.
METHODS: Shadow rotations were developed and integrated as a mandatory component of a required didactic/laboratory introductory course to pharmaceutical care. Students are assigned to two different shadow rotations (ambulatory and inpatient). Sites are chosen based on PEP criteria and preceptors must have previous experience with P4 students. P1 students shadow P4 students (or preceptor pharmacists) to foster initial development of practice skills. P1 students complete a set of criteria based on ACPE guidelines which include a review of patient medical orders and/or prescriptions, patient medical chart/profiles, drug dosage forms, storage, preparation, dispensing of medications, practitioner interaction with patients and prescribers concerning adherence, interventions and drug therapy, site information systems, specialty services, and pharmacist education.
RESULTS: To date, 210 students and 90 preceptors have participated in the shadow program. Overall, this ongoing program facilitates the course work in the P1 curriculum by reinforcing students understanding of adherence, counseling, and favorable patient outcomes.
CONCLUSION: The student receives valuable experience as a basis for a career path choice and expectations of future rotations.

343. Development and implementation of a required pharmacotherapy rotation in a family medicine physician residency program. *Ila Mehra Harris, Pharm.D., BCPS*, Stacey Abby, Pharm.D.; St. Louis College of Pharmacy, St. Louis, MO; University of Minnesota, St. Paul, MN.

PURPOSE: Family medicine physicians need a broad knowledge base of drug therapy to make rational, patient-specific, and cost-effective therapeutic decisions. Prescribing habits are learned during residency training.
METHODS: A required pharmacotherapy rotation for all first year family medicine resident physicians was developed. The resident spends three half-days a week for one month working directly with the clinical pharmacist. Weekly topic discussions cover evidence-based drug therapy of chronic

diseases, biostatistics, and literature evaluation. In a weekly pharmacy referral clinic, the resident physician observes, then sees patients for the management of complicated medication regimens, travel medicine, smoking cessation, anticoagulation, diabetes, and asthma. Other hands-on experiences include chart review with evaluation of medications, conducting medication histories, and assisting in formal and informal consults. One half-day is spent in a community pharmacy to observe and better appreciate the cognitive roles of pharmacists. The resident also reviews two new drugs for publication in a monthly newsletter. In addition, the resident reviews a class of drugs to learn the process of medication selection for a personal formulary, and presents it to a P&T Committee. A longitudinal pharmacotherapy curriculum consisting of monthly drug therapy lectures and a monthly journal club is also incorporated into the 3-year residency program.
RESULTS: Fourteen physician residents have completed the pharmacotherapy rotation since implementation. Self-perceived knowledge and understanding of anticoagulation and smoking cessation improved, based on a survey. Results concerning drug therapy selection are pending. A required pharmacotherapy rotation appears to be an effective method of teaching family medicine residents rational prescribing.

344. Evolution of the clinical pharmacy curriculum at the University of Concepción, Chile; pharmaceutical care: the next step? *Eliza H. Hoernle, Pharm.D.*, Maria C. San hueza, Q.F., Victoria E. Gidi, Q.F., Eliana Aste, Q.F., Mariela López, Q.F.; University of Concepción, Concepción, Chile.

We will describe the development of clinical pharmacy education and training at the University of Concepción, a 5-year baccalaureate degree program, our current curriculum, and obstacles to the implementation of pharmaceutical care.
In 1971, Eric T. Herfindel, assistant clinical professor at the University of California San Francisco, was invited to Santiago and planted the seeds of clinical pharmacy in Chile. Faculty from the University of Concepción participated in the training program whose objective was to provide a model and stimulate the development of clinical pharmacy. Over the following 9 years, clinical pharmacy was incorporated into the curriculum at the University of Concepción in the form of didactic courses (e.g., therapeutics), practical experience programs or clerkships, and a 6-month clinical pharmacy hospital internship. The original three clinical faculty members established their practice site in a 500-bed public hospital where, over a 7-year period, they simultaneously developed the clinical curriculum and established a drug information center that provides services all eight regions of Chile. The initial clinical practice site has since expanded to a second drug information center at the largest regional public hospital (1000 beds) per physician request and the faculty has increased to six members, including one U.S.-trained Pharm.D.
The logical next step in the clinical pharmacy curriculum should entail incorporating pharmaceutical care and providing practice models. However, in Chile, the opportunities for practicing clinical pharmacy are extremely limited. We will discuss the obstacles faced by a developing country in expanding the pharmacist's role and the University's potential role in combating these obstacles.

345. A review of clinical pharmacy education in the faculties of pharmacy in Nigeria. *Ayodele O. Kayode, B.Pharm., MPSN*, Olusegun O. Oyekan, B.Pharm., MPSN; University of Benin, Benin City, Nigeria.

PURPOSE: To assess the extent of introduction of clinical pharmacy education to the curricula of the nine faculties of pharmacy in Nigeria.
METHODS: A personal visit was made to all the nine faculties of pharmacy in Nigeria. Their curricula were analyzed for clinical pharmacy education involvement. Facilities on ground for clinical pharmacy education were noted. Also, oral interviews were conducted among the students and members of staff of the clinical pharmacy department of each institution.
RESULTS: The University of Nigeria, Nsukka (UNN), seems to take the lead in clinical pharmacy education with 290 hours of clinical pharmacy involvement to the curriculum, which represents a 25.9% contribution to the curriculum. The institution also runs a 3-year postgraduate program which leads to the award of a Doctor of Pharmacy degree. University of Benin, Benin City, seems to follow UNN closely in clinical pharmacy education with 390 hours of clinical pharmacy involvement in the curriculum, which represents a 25.7% contribution to the curriculum. There is also a post-graduate course in clinical pharmacy of which a masters degree is awarded. Ahmadu Bello University, Zaria, has 360 hours of clinical pharmacy education, which represents a 22.2% contribution to the curriculum. Obafemi Awolowo University, Ile-Ife, has 196 hours of clinical pharmacy education, which represents a 14.5% contribution to the curriculum. The other schools of pharmacy have clinical pharmacy education to varying degrees.
CONCLUSION: Nigeria has introduced major changes in the pharmacy curriculum, but failed to break with the past.

346E. Case-based therapeutics: alternative to traditional lectures in a large didactic course. *Steven Kayser*, Michael Winter, Peter Koo, Thomas Bookwalter; University of California San Francisco, San Francisco, CA.

347. Application of computerized case studies to problem-based learning. *Aaron D. Killian, Pharm.D., BCPS*, Carolyn L. Bouma, Ph.D., B. Chip Shaw, M.S., Jennifer Barnidge; Texas Tech University Health Sciences Center, Amarillo, TX.

PURPOSE: To describe a teaching technique that follows curricular innovations in ill-defined, problem-based learning at other professional institutions.
METHODS: Within a pharmacy curriculum involving both didactic and problem-based learning, a web-based computer program has been developed. The program is utilized in the case studies course series (11 credit hours), which is offered for three sequential semesters beginning in the second year. These courses involve application of principles of pathophysiology and therapeutics to drug therapy issues through candidate-centered, problem-based instructional processes. Doctor of Pharmacy candidates utilize personal notebook computers to access and store relevant information during twice-weekly, tutor-supervised group sessions. The program contains 1197 queries (202 patient interview, 895 lab/diagnostic, and 100 physical exam/mental status) designed to field virtually any question a candidate might ask regarding an individual patient case. Other features include facile modification of patient data bases for case creation or modification, reduced/limited access time for information retrieval, student participation from remote sites during extramural clerkships in the fourth year, and capacity for graphics display (e.g., scanned diagnostic images, patient photographs, video clips, and audio files for physical examination). Eventually, the program will permit chat room discussions, advanced search options, and tracking of group queries to facilitate tutor assessment of group reasoning, logic, and thought processes.
RESULTS: The program will be demonstrated at the upcoming meeting.
CONCLUSIONS: Computerized case studies offer a unique approach to classroom instruction that closely emulates real world patient scenarios.

348. An international collaborative clerkship teaching program as a part of required clerkships in a U.S. college of pharmacy. *Roger D. Lander, Pharm.D., FCCP, BCPS*, Duncan McRobbie, M.S., Robert P. Henderson, Pharm.D., FCCP, BCPS; Samford University, Birmingham, AL; St. Thomas' and Guy's Hospital Trust, London, U.K.

PURPOSE: To describe an international advanced practice experience (APE) which is utilized in fulfilling curricular requirements in a Pharm.D. program at a U.S. pharmacy school.
METHODS: During each of the past five academic years, final year Pharm.D. students from Samford University (n=10) have participated in a 2-month, international APE. This has been principally performed with pharmacists at the St. Thomas' and Guy's NHS Hospital Trust in London, England, with an emphasis on adult medicine specialties and a broad exposure to the English health care system. Formative and summative student evaluations are done utilizing Samford's evaluation instruments; student evaluations of sites and preceptors are also performed.
RESULTS: This international experience has been well received by students and preceptors. Student evaluations demonstrate solid academic preparation, useable skills, and excellent motivation. Student evaluations of the experience are very similar to their cohort group of classmates in the U.S. with regard to the academic benefits of the experience, but show very positive ratings in the areas of cultural exposure, maturity enhancement, and life broadening development. Because of these positive experiences, the University and Trust are exploring alternate funding mechanisms to enhance the availability of the experience.
CONCLUSIONS: This program has produced several positive outcomes: demonstration that expected competencies in an APE can be achieved through this model; broadened cultural and professional awareness among participants; enhanced collaborative opportunities among faculty and NHS pharmacists; and improved understanding and implementation of practice and teaching models because of the significant interaction between pharmacists in these two countries.

349E. Interdisciplinary problem-based HIV teaching for medicine, pharmacy, nursing, and social work students. Ian Bowmer, M.D., *Rebecca Law, Pharm.D.*, Sandra MacDonald, M.S.N., Gale Burford, Ph.D., M.S.W.; Memorial University of Newfoundland, St. John's, NF, Canada.

Presented at the Annual Meeting of the American Association of Colleges of Pharmacy, Indianapolis, IN, July 1997.

350. Dental clinical pharmacy practice: a unique teaching, service, and clerkship site. *Cindy L. Marek, Pharm.D.*, Karen A. Baker, M.S.; University of Iowa, Iowa City, IA.

For more than 25 years, the University of Iowa has offered clinical clerkship sites at the college of dentistry. Beginning with a B.S. level clinical instructor, the program has expanded to include two full-time clinical pharmacy faculty members, each holding joint appointments in the colleges of dentistry and pharmacy. Approximately 24 pharmacy students per year participate in the clerkship site where they play an active role in the management of dental patients. Clinical pharmacy faculty teaching responsibilities in the dental

college increase yearly and include participation in over 20 courses for a total of 100 hours of didactic contact. Pharmacy and dental students receive extensive clinical and didactic instruction in the pharmacotherapy of mucosal diseases, head and neck pain, oral infectious diseases, and drug-related problems in dentistry. In addition, the clinical pharmacy faculty operate an in-house pharmacy specializing in formulation of medications used in the management of mucosal diseases and development of chemotherapeutic products for periodontal disease. Faculty research areas include innovative therapies for oral stomatitis, efficacy of post-surgical analgesics, comparative efficacy of oral home care products, and novel treatments for head and neck pain. Faculty members spend 40% of their time providing consultations to the departments within the dental school, external clinical pharmacists, and dental practitioners throughout the U.S. and Canada. Dental clinical pharmacy services at the University of Iowa have been a resounding success as indicated by ever increasing didactic responsibilities, demand for internal and external consultations, and national and international visibility.

351. Pharmaceutical care: basic element in pharmacy curricular design. *A.M. Martínez Sánchez, M.S.*; University of Oriente, Santiago de Cuba, Cuba.

Pharmaceutical care, in which a practitioner assumes the responsibility for the outcomes of drug therapy in patients, is truly a revolutionary concept in the practice of pharmacy. All practice functions contained within this concept center on the patient. To perform this function, pharmaceutical education must facilitate students acquiring relevant knowledge, skills, attitudes, and values accordingly.
PURPOSE: To design a curricular pharmacy model that incorporates pharmaceutical care as a basic element.
METHODS: The methodology employed is based on the theory of dynamic of curricular design planned by the Cuban commission to implement changes in pharmaceutical education.
RESULTS: Professional problems, scopes of action, spheres of performance, and the Professional Pharmacy of Wide Profile concept were taken into account. The pharmaceutical care concept, as a professional way of behavior in which didactic expression is the essential logic of the profession, and its didactic and methodologic value were documented in this model.
CONCLUSIONS: This model could serve as an alternative way to achieve changes in pharmacy education, training students to deliver clinical pharmacy services according to this new philosophy.

352E. An introductory clinical skills course utilizing cooperative learning. *Christine K. O'Neil, Pharm.D.*; Duquesne University, Pittsburgh, PA.

Presented at the Annual Meeting of the American Association of Colleges of Pharmacy, Aspen, CO, July 17-22, 1998.

353. Post-graduate clinical pharmacy inservice training of the Institut Central des Hôpitaux Valaisans, a management tool. *Jean-Philippe Reymond, Ph.D.*, Stefan Marty, Ph.D.; Institut Central des Hôpitaux Valaisans, Sion, Switzerland.

As pharmacy of a private foundation delivering services to health care institutions, innovation and validation of services is essential to ensure long-term business goals. Post-graduate clinical pharmacy inservice training is one tool to follow up customers' evolving needs.
The objectives of the 13-month European Society of Clinical Pharmacy-accredited program for two pharmacists simultaneously are to build up a sound knowledge of the clinical environment and to teach pharmaceutical care with emphasis on cooperation in the health care team, patient counseling, and feedback to pharmacy management. After introduction to the working environment and laboratory training, clinical training in medicine begins with daily review of patients' medical records followed by rounds with the health care team and provision of patient education. Evaluation is assessed clinically and with case presentations three times a year. Meetings once a week provide a basic follow up. A research project allows the development of specific services. Each resident spends 4 weeks in the division of clinical pharmacology of a university hospital to learn specificity and complementarity of clinical pharmacology and clinical pharmacy services.
Since 1991, 14 pharmacists have completed the program. Their actual sites of professional involvement are: industry (1), community (6), administration (1), and hospital (6). Abstracts and publications were issued based on research activities of this program. This program, partly funded by the Swiss Pharmaceutical Society, is the only clinical pharmacy inservice training provided in Switzerland. Due to its experience and involvement at the regional hospital level, it could be easily implemented in similar Swiss or foreign environments.
A clinical pharmacy inservice training is not only an educational opportunity but also an important management resource for the development of new pharmaceutical services.

354. Evolution of an alternative medicine pharmaceutical care clerkship. June E. Riedlinger, Pharm.D., *Lana Dvorkin, Pharm.D.*; Massachusetts College of Pharmacy and Allied Health Sciences, Boston, MA.

PURPOSE: The purpose of this project was to create a specialized clerkship in complementary alternative medicine (CAM) for Pharm.D. students. The clerkship's primary purpose is to give students an opportunity to study and explore the potential impact of CAM on conventional drug therapy and to establish a working relationship between pharmacists and CAM practitioners.
METHODS: Pharm.D. candidates are recruited after completion of internal medicine and ambulatory care rotations. Students observe and interact with CAM practitioners and patients, obtain medication histories, answer drug information questions, and can take the opportunity to experience acupuncture and a chiropractic adjustment.
RESULTS: The clerkship encompasses naturopathy, chiropracty, acupuncture, and homeopathy, allowing students to develop a better understanding of CAM by experiencing a variety of practices. The enthusiastic response of the students who participated in the original program led to increased demand from other Pharm.D. students for the rotation. Administrative support from the pharmacy practice division director and clerkship coordinator were also secured as a result of student interest and satisfaction. Evaluation of student participation by CAM practitioners acknowledged enhancement of their practice with the integration of pharmaceutical care. By the end of May 1998, nine students completed the clerkship and five more students had registered for the fall 1998 rotations.
CONCLUSIONS: The students that have taken the rotation stated that it helped them understand the principles of CAM and to assess and answer CAM-related questions with greater confidence. The CAM practitioners and their patients have expressed a great appreciation for the pharmacists' interventions.

355. An established training program which provides practicing pharmacists a forum for developing patient-focused clinical pharmacy skills. *LCDR Edward J. Stein, Pharm.D.*, Captain Michael R. Seybold, B.S.P.P.; Indian Health Service Clinical Support Center, Phoenix, AZ; Clinton (OK) Indian Hospital.

A recognized leader in pharmaceutical care delivery and patient consultation, the Indian Health Service (IHS) has developed the pharmacy practice training program (PPTP) to meet the demands of patient-focused pharmacy practice. The PPTP is an innovative training program designed to improve pharmacists' ability to deliver direct patient care in the IHS and tribal and urban program settings. Implemented in 1985 and training an average of 75 pharmacists annually, this program's goal is to improve clinical pharmacy practice by enhancing the pharmacists' patient care skills such as chart screening, communication, conflict resolution, patient education and consultation, and interviewing. Sessions are included in the physical assessment of selected diseases. A prerequisite of the program is a basic understanding of IHS pharmacy practice. Participants gain an understanding of the philosophy of IHS pharmacy practice, familiarity with IHS standards of practice, an increased sensitivity to cultural issues unique to the Indian health programs, and increased knowledge in selected areas of clinical pharmacy. The teaching relies upon a case study format, which includes role playing and practice. The cases used are derived from real situations seen in Indian health care facilities. The seminar is taught by experienced, practicing IHS pharmacists who are role models in this type of practice. Pharmacists are encouraged to attend every 2-3 years throughout their career to refresh and enhance their skills. The PPTP is recognized throughout Indian health programs as an innovative, valuable training program intended to maintain the high standards of IHS pharmacy practice.

356. Development of pharmaceutical care learning modules for staff development. *Wes K. Sumida, Pharm.D., BCPS*, Becki G. Luna, Pharm.D., BCPS; Kaiser Foundation Hospital, Honolulu, HI.

PURPOSE: This report will describe regional efforts in an HMO setting to integrate and improve the care of anticoagulated patients. Approximately 1500 patients are enrolled in our regional anticoagulation service. Pharmaceutical care learning modules were developed to enhance outpatient pharmacist's skills, with the goal of better integrating the anticoagulation clinic pharmacy services.
METHODS: All pharmacists participated in one 4-hour teaching module developed to provide knowledge, information, tools, and skills. The training modules were conducted by trained and certified ambulatory care clinical pharmacists and included didactic training, role playing, case presentations, and listening skills development. The areas of improvement we targeted included the reporting and management of drug interactions, review of lab data, and intervention on patients with less than optimal compliance.
RESULTS: Staff pharmacists have become more active in counseling patients, monitoring, and notifying the anticoagulation pharmacists of significant drug-drug interactions. Since the completion of the training modules, the reporting of significant drug-drug interactions by dispensing pharmacists to the appropriate clinical pharmacist has tripled (138 notifications in the second quarter and 361 notifications in the third quarter, 1998). Elevated international normalized ratio values related to non-notification of drug-drug interactions with warfarin also decreased (five in second quarter, two in third quarter).
CONCLUSIONS: The successful embracing of skills development and active participation by our staff has allowed our anticoagulation service to improve its ability to serve our patients and integrate their care to a level unobtainable in the past.

357. Training community pharmacists to evaluate the health-related quality of life of patients receiving antidepressant drugs. *A. Thomas Taylor, Pharm.D.*, R. Leon Longe, Pharm.D., William J. Spruill, Pharm.D., William E. Wade, Pharm.D.; University of Georgia, Augusta, GA.

The Clinical Outcomes Research Group (CORG) of the University of Georgia (UGA) College of Pharmacy has developed educational programs to train independent community pharmacist investigators in a variety of practice-based research skills and techniques.
PURPOSE: The purpose of this program was to train pharmacists to properly document the health-related quality of life (HR-QOL), demographic, and drug-related information of patients with a variety of medical and psychiatric illnesses.
METHODS: Approximately 50 pharmacists were trained by CORG faculty during regional meetings at four locations in Georgia. An investigator's guide was developed by faculty and reviewed with pharmacists during meetings and later by mail. The guide and meeting presentations focused on an overview of the project, a cover letter to patients approved by the UGA investigational review board, and a patient inclusion checklist. A sample form with instructions for collection of demographic data, adverse drug reaction data, as well as the SF-36, were included.
RESULTS: Pharmacists have identified and evaluated 58 patients with depression who are receiving an antidepressant as their only primary routine medication. Results indicate that community pharmacists are willing and interested in participating in HR-QOL evaluations. Practitioners have collected data in a professional and precise manner, with great attention to detail.
CONCLUSION: Pharmacists have successfully utilized HR-QOL techniques to evaluate and monitor patients receiving antidepressant medications.

358. Clinical pharmacy in India: propagation through education. *Sanjay P. Wate, M.Pharm.*, Mohan K. Kale, M. Pharm.; Nagpur College of Pharmacy, Nagpur, India.

PURPOSE: Clinical pharmacy practice in India is the beginning stages today. In a subcontinent-sized nation of 900 million, with a population to bed ratio of 1300:1, and over 40% of nationals below the poverty and literacy line, the health care system is insufficient and inefficient and does not have active involvement of pharmacists. A renewed commitment to clinical pharmacy practice is imperative in India. In the past few decades, Indian pharmacy education had drifted more toward the pharmaceutical industry than hospital service resulting in an affiliation to technical education rather than health education. Of late, however, the realization has dawned for good, and clinical pharmacy practice is finding a place in the pharmacy curricula of some Indian universities. The purpose of this paper is to summarily present the need and means of educating pharmacists with a clinical orientation in India and other similar countries.
METHODS: A positive and forward step taken in preparing present and future pharmacists for serving the masses rather than merely machines, is the inclusion of the faculty of pharmacy in the health universities of some Indian states. The authors' state is one such state. The new, nation-wide uniform pharmacy curriculum includes principles and practices of hospital and clinical pharmacy modeled on institutes in the U.S. and Australia. Some universities, under their faculty exchange programs, are regularly having teachers trained in Australia. Specialization in clinical pharmacy at the post-graduate level is started in some institutes. Awareness campaigns, training camps, and continuing education programs are conducted to in-service hospital pharmacists. For budding pharmacists, training in hospitals and wards, with bedside patient service, are arranged. (The authors' pharmacy college has medical and dental colleges as sister institutes where such training is possible). Seminars and debates on significance, spread, and scope of clinical pharmacy have become a regular feature. The co-author has participated as a resource person in them.
RESULTS: The concept of clinical pharmacy is in its infancy in India, but the drive to re-orient the pharmacy profession is gradually gaining momentum. Doctors, drug manufacturers, and pharmacists have realized its need and importance. The Ministries of Health and Education are also persuaded to make statutory amendments necessary to involve pharmacists as an integral component of the health care system. The seminars and lectures on clinical pharmacy have been overwhelmingly well attended and appreciated. A new social identity of the pharmacist is expected to be discovered through these efforts. The stage of initiation is over and the next stage of intensification is now in progress.
CONCLUSIONS: The medical set-up in India and other developing countries has to remold itself to include the pharmacist's role as complementary to doctors. This will not only reinforce the health service but also lead to more rational and relevant, careful and correct, fast and foolproof treatment. For this, pharmacists have to update themselves through exposure to and experiences in patient care. Education is the best stage and step to achieve this. Once the pharmacist is educated for the clinical role, masses can soon realize the importance and indispensability. In the poverty and illiterate ridden regions of the world, unaffordable medical and inaccessible drug information services are believed to become more available with patient care, counseling, and compliance done by a people-friendly pharmacist.

359. An introduction to the profession of pharmacy: a course sequence for entry level Pharm.D. students. Cathi Dennehy, Pharm.D., Lisa Kroon, Pharm.D., Kenneth W. Lem, Pharm.D., Joanne O. Whitney, Pharm.D., Ph.D., *Michael E. Winter, Pharm.D.*; University of California San Francisco, San Francisco, CA.

PURPOSE: To develop an early, comprehensive, integrated series of pharmacy practice courses to introduce students to the profession of pharmacy. To our knowledge, the depth and breadth of this course sequence (11 total quarter units) is unique for first-year, entry-level Pharm.D. students and is an integral part of our curriculum revision developed in response to the changing health care system and pharmacy practice opportunities for our graduates. The two primary objectives are to expose the students to a wide variety of practice and educational opportunities and prepare them for their first experience as an apprentice pharmacist. To accomplish this, the students require a body of knowledge, professional practice skills, and an appreciation for the changing health care environment, the profession, and the patient.
METHODS: The course format includes presentations, conferences, workshops, self-directed learning, group projects, fieldwork, and interviews with patients and pharmacists. Learning experiences are linked and designed to build on one another. For example, students have presentations on non-prescription products, communications, and ethics. These are supplemented by fieldwork assignments to review the products available in a pharmacy. Students then participate in conferences, where they share and apply information, using the SOAP format, to solve case-based clinical problems. Evaluations include students' self-assessment and peer review to critique their effectiveness in acquiring, applying, and sharing information.
RESULTS AND CONCLUSION: The pharmacy practice series provides a novel early development of life-long learning and problem solving skills, and prepares students for their first professional pharmacy practice experience. Student satisfaction surveys will be presented.

360. www.jclinpbl.org: an electronic peer-reviewed journal dedicated to problem-based learning. *David S. Ziska, Pharm.D.*, Gary D. Theilman, Pharm.D., Philip A. Bushby, D.V.M., M.S., Douglas C. Anderson, Jr., Pharm.D., Brian L. Crabtree, Pharm.D., Natalia M. Kudych, Pharm.D., J. Randall Pittman, Pharm.D.; University of Mississippi Medical Center, Jackson, MS.

Our purpose is to document and explain the mission, scope, and focus of *The Journal of Clinical Problem-Based Learning.* In addition, we will describe the opportunity that this journal provides those involved in problem-based learning (PBL) case writing.
The mission, scope, and focus of the journal are to further the development and application of PBL; and to publish original case materials, descriptive reports, scholarly research, editorials, and letters concerning PBL in the health sciences. The rationale behind including case materials in the scope of the journal relates back to our struggle with identifying a peer-reviewed source to publish and receive academic credit for PBL case writing.
By developing such a journal, the editorial staff envisions this PBL-focused journal contributing to the development and permanent inclusion of this important pedagogy in health science education. This first issue includes PBL cases designed for fifth year pharmacy students and one descriptive manuscript from the editors of the journal. Our intent is to get the ball rolling with the first few issues through editorial contributions and then, through publicity, have external contributions from all health education disciplines dominate future issues.
To ensure quality, the editorial staff has selected only external reviewers for the first issue, and final editorial advice to publish this issue was placed in the capable hands of Dr. Philip Bushby of Mississippi State University's College of Veterinary Medicine.

361. How to start a pharmacy practice residency program. *Khaled M. Alhaidari, Pharm.D.*, Grant E. Sklar, Pharm.D.; King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia.

A pharmacy practice residency is an organized, directed, post-graduate training program in the field of pharmacy practice. The practice residency program at King Faisal Specialist Hospital will be described. Topics covered include: residency justification, determination of the focus of the residency, organizational chart, funding, resident selection, affiliation with the St. Louis College of Pharmacy, accreditation, and program expansion. King Faisal Specialist Hospital's 2 years of experience with a pharmacy practice residency program will be used to illustrate the process.

362. A non-insulin dependent diabetes mellitus patient counseling training program for community pharmacists in Tasmania, Australia. *Yolanda R. Robles, Ph.D.*, Roger H. Rumble, Ph.D.; University of the Philippines, Manila, Philippines; University of Tasmania, Tasmania, Australia.

PURPOSE: To develop and implement a training program on patient counseling that is responsive to identified contextual needs, the learning outcomes of which could be measured in terms of workplace performance.

Also, to determine specific factors that affect the integration of learning into practice.
METHODS: The main structural basis of the training program was a continuing pharmacy education system developed previously by the authors. The elements of this system are adherence to adult learning principles and the inclusion of training needs assessment and contextual analysis, a suitable curriculum approach, and workplace performance evaluation as part of the whole educational design. Quantitative and qualitative research methods were used to assess the training needs of community pharmacists, information needs of non-insulin dependent diabetes mellitus (NIDDM) patients, and gaps in the provision of NIDDM patient counseling by key health professionals in the diabetes health care team. The training program employed a variety of learning strategies and settings. Change in knowledge was measured using paper and pencil tests while counseling skills were assessed by videotaped counseling sessions and written case scenarios. Within 6 months after the training, participants' performances were evaluated through their use of NIDDM patient counseling kits and by qualitative methods.
RESULTS: The training program developed was fairly successful in enhancing community pharmacists' counseling performance, albeit in a highly individualized manner. The workplace evaluation identified some factors affecting the integration of learning into practice and elucidated details of contextual nuances ascribed to those factors by individual pharmacists.
CONCLUSION: An educational program, developed based on the elements of a continuing pharmacy education system introduced here, is more likely to demonstrate the positive impacts of learning interventions to pharmacy practice. Qualitative research methods are useful where details of pharmacists' perspectives are sought to explain observed practice phenomena.

363. FarmaDiaβ: the pharmacist in diabetes care. *Maria Augusta M.S. Soares*; Associação Nacional das Farmácias, Lisboa, Portugal.

The community pharmacists are running a health promotion program designed to increase the quality of care to diabetic patients. The FarmaDiaβ program follows the European guidelines for pharmacists recognized by the EuroPharm Forum and St. Vincent Declaration Action Program (SVD). FarmaDiaβ targets are to increase public awareness about diabetes, increase diabetes early detection, and to reduce diabetes complications.
The community pharmacists are working in collaboration with the other health professionals. In 1998 there are over 400 (out of 2500) pharmacists who were trained to develop FarmaDiaβ. Together, there are three hospital pharmacies running the program.
Recently, almost all the community pharmacists were trained to be involved to increase the quality of care as they dispense self-surveillance devices, medicines, and insulin administration devices for free, without any profit. Moreover, when they dispense these products, the pharmacist is to analyze patients' booklets to confirm they are compliant with physicians' prescriptions. The pharmacists are responsible to teach the use of devices and to inform patients regarding the importance for them to belong to a diabetes association.
We shall present the pharmacists' responsibilities in the FarmaDiaβ program in detail and some results about the analysis of drug treatment, patients' knowledge before pharmacists' education, and the experiences of pharmacists in the early detection of diabetes.

364. Use of formulary meter conversion to screen for diabetes complications. *Karen A. Tisdel, Pharm.D., BCPS*, Evan M. Sisson, Pharm.D., Christina Telford, Pharm.D., Franklin J. Zieve, M.D., Ph.D.; McGuire VA Medical Center, Richmond, VA.

At McGuire VA Medical Center, 18% of patients have diabetes, which is responsible for most amputations, one-third of dialysis and eye clinic patients, and much cardiovascular disease. The mandatory conversion to a new home blood glucose meter (BGM) provided an opportunity to screen most patients with diabetes for treatable complications as recommended by the ADA.
PURPOSE: To identify and screen patients with diabetes who may be at high risk for treatable complications. To establish a baseline of diabetes care in this population. To increase patient and provider awareness of diabetes.
METHODS: Patients were identified through blood glucose test strip electronic prescription records. A letter was sent to each patient specifying appointment time and purpose of the visit. The screening included new BGM training, ADA recommended laboratory tests, blood pressure, weight/height, monofilament foot exam, and date of last dilated eye exam. After the screening, each patient received a letter summarizing his results.
RESULTS: Two thousand four hundred forty-three patients were identified; 1958 attended the screening. Preliminary baseline values include: 25% with HbA_{1c} > 9%; 52% with microalbuminuria (> 30 mg/g creatinine); 31% with non-HDL-C > 160 mg/dl, and 36% with HDL-C < 35 mg/dl; 31% with MAP > 107 mm Hg; 43% with abnormal foot exam; and 35% reporting no eye exam in the past year.
CONCLUSIONS: More than half of the population screened has increased morbidity or mortality risk. These results indicate that broad-based diabetes complications screening is useful to prioritize those patients who may be in need of additional care.

365. Patient outcomes associated with a diabetes pharmacotherapy certificate program. *Julienne K. Kirk, Pharm.D., BCPS*, Michelle Goode Maddox, Pharm.D.; Wake Forest University, Winston-Salem, NC.

PURPOSE: To describe the implementation of a diabetes pharmacotherapy certificate program and patient-associated outcomes, including diabetes education evaluation and diabetes quality of life (DQOL) surveys.
METHODS: A diabetes pharmacotherapy certificate program was implemented for 25 pharmacists. The first stage consisted of completing an in-home study manual and post-test (minimum score 80%). Pharmacists participated in a 2-day skills seminar followed by case presentations. The preparation of six patient work-ups and development of an action and implementation plan was required. Prior to the delivery of education by the pharmacist, the patient completed a DQOL survey. At the completion of all education by the pharmacist, another DQOL survey was completed along with an evaluation by the patient of diabetes education provided. This information was mailed by the patient to the course instructor with emphasis that all survey data would be confidential with regard to patient identification.
RESULTS: To date, 23 pre- and post-DQOL surveys have been completed with improvement found in the overall satisfaction scale. Analysis has not shown a statistical difference in pre- and post- surveys. Another class has recently been completed and more data will be compiled. The assessment of the pharmacists' educational interventions was also evaluated by a questionnaire and the results of this instrument have shown an overall positive response.
CONCLUSION: Certificate programs are continuing to emerge and further data are needed with regard to specific diabetes outcomes (e.g., HgA_{1c}, complications, and hospitalizations). Our data indicate a trend toward improvement in patient satisfaction with diabetes care and education provided.

366. Development of geriatric clinical pharmacy services in Australia. *Douglas J. Smith, M.Ed., B.A., Dip.Ed, MACE*; Australian Association of Consultant Pharmacy, Deakin West, Australia.

PURPOSE: This presentation reports on the development and implementation of a new federal government-funded clinical pharmacy service in Australian nursing homes. This service is the first additional professional service to receive government recognition and remuneration, based on anticipated improvements in health and cost outcomes.
METHODS: The report will describe the antecedent factors, design and implementation processes, training and assessment of pharmacists, and the level of participation by pharmacists and nursing homes. The report will also discuss barriers to implementation, such as the need for pharmacists to develop collaborative relationships with medical practitioners and the systemic organizational barriers within nursing homes.
RESULTS: After just 18 months, the program achieved participation by over 65% of nursing homes, with over 500 pharmacists trained and accredited to provide the service, with many more currently undergoing training. Government funding has now been increased to expand the service to hostel (assisted living) facilities and to at risk ambulatory patients.
CONCLUSION: This new service is a significant new development for Australian pharmacy practice. Federal government funding has facilitated the implementation of a national program providing nursing homes with access to clinical pharmacy services. The profession has responded by establishing a specialized training, assessment, and accreditation process to identify and prepare pharmacists to provide the service. This service is the first of many additional professional services which will be developed and implemented in Australia, and which will substantially change the nature of pharmacy practice to incorporate a clinical pharmacy orientation.

367. Pharmacists' role in managing an outbreak of influenza A in long-term care. *Susan K. Bowles, Pharm.D.*, Lisa Ruston, B.S., Natalie Kennie, Pharm.D.; Sunnybrook Health Science Centre, University of Toronto, Toronto, ON, Canada.

PURPOSE: To describe the pharmacist's role in managing an outbreak of influenza A in long-term care.
METHODS: During February 1998, an outbreak of influenza A was confirmed in a 570-bed long-term care facility. Infection control measures to prevent further spread included a recommendation for chemoprophylaxis with amantadine. Pharmacists assumed responsibility for four aspects of chemoprophylaxis: 1) developing educational material for patients and families; 2) individualizing dosing based on renal function, pre-existing diseases, and concomitant medications; 3) evaluating suspected adverse effects reported by nursing; and 4) distributing amantadine in a timely fashion.
RESULTS: Pharmacists developed an information leaflet for patients and families. The overall acceptance rate of chemoprophylaxis was 91% throughout the institution. Each patient was dosed individually, with 58% receiving 100 mg daily, 39% receiving 100 mg every other day, and 3%

prescribed 100 mg weekly. However, no standard nomogram was used as each pharmacist accessed different references. Pharmacists confirmed adverse effects in 22 patients, with confusion being reported the most frequently (54%). Most patients tolerated a dosage reduction rather than discontinuing the medication. The first dose of amantadine was provided to the nursing units within 3 hours of orders being written. No deaths occurred among the 48 patients with influenza and only one patient developed a post-influenza pneumonia.
CONCLUSION: Pharmacists can play an active role in managing an outbreak of influenza A. Based upon our experience we are in the process of developing policies and procedures to ensure readiness in the event of any future influenza outbreaks.

368. Implementation of a pharmacist-staffed medication adherence clinic to improve virologic outcomes in patients with HIV infection. Patrick G. Clay, Pharm.D., *R. Chris Rathbun, Pharm.D.*; University of Oklahoma, Oklahoma City, OK.

PURPOSE: An innovative, pharmacist-managed clinic for indigent patients with HIV infection is described.
METHODS: Highly active antiretroviral therapy (HAART) is the cornerstone of management in patients with HIV infection. For optimal and sustained virologic response, these medications must be taken in strict accordance with prescribed doses and administration times. Retrospective evaluation of virologic outcomes in our HIV clinic population revealed that only 54% of patients had achieved a viral load less than 400 copies/ml (RT-PCR). In July 1998, a pharmacists' clinic was implemented with the goal of improving patient outcomes from HAART.
RESULTS: All patients with suspected adherence problems or documented virologic failure are referred by HIV clinical staff for evaluation. Patients are scheduled for an initial 1-hour appointment followed by one-half hour follow-up appointments at 2, 4, and 8 weeks, if necessary. Evaluation of patients' beliefs regarding their HIV disease are explored as well as other barriers to adherence. Patients are extensively counseled regarding drug administration issues as well as side effects and their management. An individualized administration schedule is prepared to tailor patients' therapy to their lifestyles while promoting practices to effect optimal treatment outcomes. Clinic visits are scheduled for one afternoon a week and are reimbursed. Virologic outcomes are being tracked to evaluate the clinic's success.
CONCLUSIONS: Pharmacists with a background in HIV disease management are ideally suited to counsel and promote effective adherence practices within HIV-infected patients. This clinic can serve as a model for other institutions providing ambulatory services to individuals with HIV infection.

369. HIV patient drug therapy knowledge before and after receiving clinical pharmacy services and associated patient satisfaction. *Suellyn J. Sorensen, Pharm.D., BCPS*, Susan E. Fisher, Pharm.D., Vicki M. Wilkey, M.S.N., N.P., Herbert E. Cushing, M.D.; Indiana University Hospital; Butler University, Indianapolis, IN.

PURPOSE: To assess patient drug therapy knowledge before and after receiving clinical pharmacy services in an HIV/AIDS clinic and to measure patient satisfaction with these services.
METHODS: A drug knowledge questionnaire was distributed between December 1997 and October 1998 to patients in the HIV/AIDS clinic who were referred for clinical pharmacy services. The first seven multiple choice questions were designed to evaluate general medication knowledge; questions eight through eighteen focused on protease inhibitors. Clinical pharmacy services provided to these patients included, but were not limited to, disease and medication counseling, adherence assessment and management, ensuring appropriate drug usage and dosage, and screening for drug interactions and adverse reactions. Post-questionnaires were administered after the pharmacist visit at follow-up appointments, 1-9 months after completing the pre-questionnaire. A 15-question, 5-point Likert scale, satisfaction survey was distributed after completion of the first pharmacy visit.
RESULTS: Pre-questionnaires were completed by 107 patients and the average score was 84.3%. The post-questionnaires were completed by 59 patients and the average score improved to 97.7%. Ninety-three percent of patients who missed one or more questions on the pre-questionnaire improved their score. The most frequently missed questions related to resistance and which protease inhibitor they were taking. The average (n=47) satisfaction score with the clinical pharmacist's services was 4.78 (1 = poor, 5 = excellent).
CONCLUSION: HIV patient drug therapy knowledge substantially improved after receiving clinical pharmacy services. Based on the satisfaction survey results, patients appeared to be highly satisfied with the services they received from the clinical pharmacist.

370. Doctoral clerkship opportunities in a Pharm.D. candidate-operated medication adherence clinic in an ambulatory care HIV setting. *Lori D. Esch, Pharm.D.*, Mark J. Shelton, Pharm.D., Gene D. Morse, Pharm.D., FCCP, BCPS; State University of New York at Buffalo, Buffalo, NY.

PURPOSE: Polypharmacy in HIV leads to complex administration schedules and potential drug interactions. With patients living longer, diagnosis of co-morbidities is further complicating pharmacotherapy. These diseases may be neglected when care is being provided by physicians specialized in HIV. The medication adherence clinic (MAC) was designed to provide intensive pharmaceutical care to these patients and provide a unique training facility for Pharm.D. candidates (PDCs).
METHODS: A Pharm.D. reviews all incoming HIV-RNA results and protease inhibitor plasma concentrations to identify patients for evaluation by the PDC. Additional patients are referred by physicians, nurses, or case managers. During four half days each week, patients are scheduled to see a PDC in the MAC. After patient interview and evaluation, written recommendations are provided to the referring person/agency and follow up is planned. Particularly complex patients may be referred to a weekly multidisciplinary conference for discussion. In certain situations, protocol agreements allow the PDC to authorize orders for certain medications or laboratory tests.
RESULTS: Reasons for referral included HIV education, initiation or changing HIV therapy, potential drug interactions, adherence assessment/enhancement, or virologic failure. Non-HIV disease states such as hyperlipidemia, asthma, diabetes, and hypertension are also addressed. Currently, study is underway to assess virologic changes in patients referred to the MAC compared with those not receiving PDC services. Student and clinical staff evaluation of the program will be presented.
CONCLUSIONS: Implementation of the PDCs into clinical functions of the MAC ensures continuous progressive pharmaceutical care service as well as clerkship experience which attempts to motivate PDCs to seek and develop innovative practice sites following graduation.

371. Clinical pharmaceutical intervention program on sequential antibiotic therapy at a general hospital. *José M. Gutierrez Urbón*, Marta Calvin Lamas, Begoña Feal Cortizas, Luis Margusino Framiñan, Isabel Vázquez Vázquez, Victoria Corbal Bernárdez, Isabel Martín Herranz; Juan Canalejo Hospital, La Coruña, Spain.

PURPOSE: To assess the impact of a sequential antibiotic therapy program (SAT) on the length of parenteral treatment and cost containment.
METHODS: Prospective review of amoxicillin/clavulanic acid (AM/CLA) and ciprofloxacin (CIP) treatments on 100% of inpatients at the unit dose distribution clinical departments of a general hospital (600 beds; 17,000 patients/year). Review took place in three steps. Step I (February 1998; 30 days) was an observational period. Step II (March-April 1998; 60 days) was an intervention and evaluation period. During this step, the pharmacy department sent prescribers an intravenous-to-oral stepdown reminder following 72 hours of parenteral antibiotics to selected patients. Selection criteria included: oral tolerability, no fever, no immunosuppression, and no antibiotic change. If no change was made after the intervention, a clinical pharmacist reviewed the medical history at the clinical department where the patient was ingressed. Step III (August 1998; 15 days) was a reevaluation period.
RESULTS:

	SAT at Day 4 (%)	Duration IV (mean days)	Cost Savings ($)
Step I - AM/CLA	42	5.3	-
Step I - CIP	31	6.9	-
Step II - AM/CLA	64	4.3	2760
Step II - CIP	80	4.1	
Step III - AM/CLA	61	4.4	1140
Step III - CIP	67	3.8	

CONCLUSIONS: A significant difference was observed when SAT was implemented in step II. This intervention can be an effective method of promoting a process on stepdown from parenteral to oral AM/CLA and CIP treatments. The pharmacy department has decided to develop a SAT period for 15 days every 2 months for antibiotic therapy.

372. Outcome of noninterventional evaluation of prescribing trends and the efficacy of one hundred orders of trovafloxacin at an inpatient setting. *S. Lena Kang-Birken, Pharm.D.*, Bruce Read, Pharm.D., Miguel Felipe, Pharm.D.; University of the Pacific, Stockton, CA; Cottage Health System, Santa Barbara, CA.

PURPOSE: Despite theoretical advantages over the older quinolones, data on practical experience with the newest fluoroquinolone, trovafloxacin, especially among hospitalized patients, is still lacking. We performed a noninterventional evaluation of trovafloxacin at an inpatient setting in terms of appropriateness, efficacy, and adverse reactions.
METHOD: One hundred orders prescribed between April 1998 and September 1998 were randomly selected and reviewed without any interventions from the pharmacist. Change of antibiotic regimen, superinfection, or death was considered as failure. Microbiologic failure was defined as isolation of resistant organisms.
RESULTS: Over this 6-month period, 342 patients received trovafloxacin. Among the 100 cases, clinical failure was reported in 12%, of which three patients expired. The most common adverse reactions included itching, rash, dizziness, and nausea.

	Indication		
	Surgical Prophylaxis n = 35	Empiric Treatment n = 53	Therapeutic Regimen n = 12
Age, mean (range)	60 years (22-88)	63 years (19-94)	66 years (38-92)
Comorbidity	17	32	9
Length of therapy, mean (range)	1.6 days (1-4)	4.9 days (1-14)	6.1 days (1-13)
Concomitant antibiotics	11	15	2
Clinical failure	1 (2.9%)	7 (13%)	4 (33%)
Microbiologic failure	0 (0%)	1 (1.9%)	2 (8.3%)
Adverse reactions	7 (20%)	15 (28%)	3 (25%)

CONCLUSION: High incidences of therapeutic failure and adverse reactions may be due to a combination of inadequate drug knowledge by the prescribers and lack of therapeutic interventions by the pharmacists. Based on our findings, trovafloxacin became restricted to use as a single oral dose for surgical prophylaxis and treatment of diabetic foot ulcers without concomitant antibiotics.

373. Impact of pharmacist-adjusted initial antibiotic dosage. *Elizabeth A. Ludwig, Pharm.D., BCPS*, Maureen S. Hossfeld, B.S., Joseph P. Balthasar, Ph.D., Corstiaan Brass, M.D.; Buffalo General Hospital; CGF Health System; State University of New York at Buffalo, Buffalo, NY.

The traditional process for suggesting a dosage interval adjustment for IV antibiotic therapy is cumbersome in that a delay often occurs before a physician response is received. A policy was developed to allow pharmacists to assess patient renal function and automatically adjust the initial prescribed antibiotic regimen for 16 selected agents according to standard dosage algorithms. For aminoglycosides and vancomycin, the Kinetex® pharmacokinetic dosing program was implemented to individualize therapy according to patient renal function, body size, and diagnosis. Peak and trough blood levels and serum creatinine are also obtained to monitor the outcome of dosage adjustments. Pharmacist training and competency assessment documentation was completed before the policy was initiated. From January 1995 through August 1998, cost savings realized via this system totaled approximately $337,000. More than 200 dosage adjustments were completed monthly with the highest percentages for gentamicin (25%), cefazolin (13%), and ampicillin/sulbactam (12%). Ceftriaxone dosage interval adjustments contributed the largest savings (30%), followed by ampicillin/sulbactam (15%), and vancomycin (11%). Quality assessments have documented pharmacist accuracy in this process as well as facilitated refinement of the Kinetex® parameter estimates specific to this patient population. This model has potential application in evolving the pharmacist's role in dosage individualization with other therapeutic agents.

374. Implementation of a pharmacy-based immunization program in an acute care facility. *Jane E. Mondino, B.S., BCNSP*, Julie H. Gilbert, Pharm.D.; Northeast Baptist Hospital, San Antonio, TX.

PURPOSE: To increase immunization rates among the elderly population for the influenza and pneumococcal vaccines by administration prior to discharge from an acute care facility.
METHODS: All patients 65 years and older admitted to our facility between October 2, 1998 and January 31, 1999 are eligible for inclusion in the pharmacy-based immunization program. Patients are screened through chart review and patient interview by the clinical pharmacists to determine their immunization history with regard to influenza and pneumococcal vaccines. A note is then left on the chart of the patients identified as eligible for either or both vaccines. The chart note enables the physician to authorize the pharmacist to counsel, obtain consent, and order the vaccine if the physician feels that it is medically appropriate. Before an order is written, the patient is given verbal and written information concerning the vaccine, and the pharmacist obtains signed consent from the patient or a family member. The vaccine is then administered prior to discharge. Immunized patients are followed for 24 to 48 hours after discharge to determine if any adverse effects occurred after receiving the vaccine. Patient information and physician responses are recorded using a database system.
RESULTS: The data gathered will be analyzed to determine pre-hospital and in-hospital immunization rates, physician response rates, patient consent and denial percentages, and adverse effects. Details of implementation, medical staff education, and functionality of the program will also be presented. Currently, over 450 patients are enrolled in the database.

375E. "G. BAD BUGS": an e-mail alert system for rapid communication and containment of multiply resistant organisms in health care settings. *Marisel Segarra-Newnham, Pharm.D., BCPS*, Marjorie J. Stenberg, B.S.N., M.S., Bryan D. Volpp, M.D., Evelyn Hunt, B.S.; Veterans Affairs Medical Center, West Palm Beach, FL.

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376. Hospital-wide patient monitoring: a staff pharmacist provided program. Carinda J. Feild, Pharm.D. Kris K. Smith, Pharm.D., *Lisa M. Vandervoort, Pharm.D.*; Orlando Regional Medical Center, Orlando, FL.

Orlando Regional Medical Center is a 415-bed community-based teaching hospital with 145 medical and surgical residents. The pharmacy department consists of 26 staff pharmacists and four clinical specialists. In addition to the clinical services provided by the clinical specialists, 2-3 pharmacist full-time equivalents/day are devoted to patient monitoring through clinical assignment. The assignment has been in place for 4 years to ensure safe, appropriate, cost-effective therapy, and provide drug information. The functions of the clinical assignment include the clinical antibiotic pharmacy service (CAPS) responsibilities, medical administration record review, and warfarin counseling. The CAPS process entails daily evaluation of all antibiotic orders for 1) appropriateness of antibiotic therapy based on the clinical diagnosis and/or culture and sensitivity data, 2) appropriateness of dosage based on organ function, 3) length of therapy, 4) IV to PO conversion, and 5) cost effectiveness. CAPS also provides a pharmacokinetic consult for every patient receiving an aminoglycoside or vancomycin. Recommendations and evaluations are documented in the AS400 pharmacy computer system for use by order entry pharmacists. Direction is provided by the clinical specialists and the medical director of CAPS (an infectious diseases physician employed by the pharmacy department), including 1 hour of formal pharmacist education several times a week. The education format includes case presentations, journal clubs, and didactic lectures. The education sessions advance pharmacist knowledge and clinical skills so that the clinical program can continue to expand. Areas of expansion include extended pharmacokinetic monitoring, disease-state guided interventions, and parenteral nutrition.

377. The clinical pharmacist in an uncommon setting: tuberculosis. *Shaun E. Berning, Pharm.D.*, Charles A. Peloquin, Pharm.D.; National Jewish Medical and Research Center; University of Colorado, Denver, CO.

PURPOSE: To describe the role of the clinical pharmacist (CP) in the highly specialized setting of tuberculosis (TB) treatment in a tertiary referral center.
METHODS: Patients seen at National Jewish are drug-resistant and have failed prior therapies for TB. The expertise of a CP was therefore sought to develop a pharmacokinetics (PK) laboratory to provide serum assays of TB medications, along with therapeutic drug monitoring. Since establishing this role, the service has expanded to include multiple roles for the CP. The CP provides medication education to all patients, colleagues, and students. The CP is responsible for the monitoring and management of toxicities and drug interactions. The CP is an integral part of the health care team providing pharmacotherapeutic expertise when choosing initial treatment regimens, performing clinical research (usually PK and new drug studies), and assisting in novel treatment approaches (e.g., intracavitary administration). By providing other services such as indigent patient assistance and telephone consultation with patients and their physicians, the CP provides a main source of continuity of care. The CPs are also involved with the education of and clinical research with TB practitioners nationally and internationally.
CONCLUSIONS: This practice serves as a model for the role of the CP in an uncommon, very specialized setting. It also serves as a model for the role of the CP in TB therapy in countries of high TB prevalence.

378. Development of an anticoagulation competency exam for internal certification. *Becki G. Luna, Pharm.D., BCPS*, Wes K. Sumida, Pharm.D., BCPS; Kaiser Foundation Hospital, Honolulu, HI.

PURPOSE: The development of an anticoagulation competency exam for internal certification of ambulatory clinical pharmacists in an HMO setting will be described. The current anticoagulation monitoring service supports approximately 1500 patients on warfarin. To ensure competency of all providers, a comprehensive exam based upon published criteria was developed.
METHODS: The anticoagulation exam was developed based upon competency requirements developed by published consensus guidelines. Recommended reference materials and published minimum competency requirements were distributed several weeks in advance of the exam. Prior to taking the exam the clinician must have completed a minimum of ten patient consultation sessions of new starts on warfarin, monitoring of 25 patients newly started on warfarin, and routine follow up of 250 prothrombin times. The exam was closed book. Passing score was set at 85%.
RESULTS: The exam was first administered to nine ambulatory clinical pharmacists with experience ranging from 1-6 years. Validity of the exam was observed with results of experienced vs less experienced practitioners. Practitioners with limited practical experience were unable to achieve passing scores, validating the difficulty level of the exam.
CONCLUSIONS: The results of our competency exam has provided an opportunity for evaluation and feedback that decreases variation in practice approaches. The results tend to confirm our own observations on the ability of our practitioners to function completely and independently. We have chosen to accept this competency exam as our standard for those practicing in the area of anticoagulation.

379. Nephrology pharmaceutical care preceptorship: a programmatic and clinical outcomes assessment. *Gary R. Matzke, Pharm.D., FCP, FCCP*, Wendy

L. St. Peter, Pharm.D., Thomas J. Comstock, Pharm.D., Edward F. Foote, Pharm.D.; University of Pittsburgh, Pittsburgh, PA; University of Minnesota; Virginia Commonwealth University; Rutgers University.

PURPOSE/METHODS: The University of Pittsburgh nephrology pharmaceutical care preceptorship program (NPCP) was conceived to acquaint health system pharmacists with the pharmacotherapeutic management of dialysis patients, enhance the delivery of pharmaceutical care, and improve patient outcomes. Since its inception in 1994, 145 pharmacists have completed the program. This survey documented their professional activities prior to and after the completion of the program, as well as their impact on anemia and renal bone disease pharmacotherapy.
RESULTS: Over 80% of the 96 respondents felt that the educational content of the NPCP was sufficient to allow them to provide pharmaceutical care for dialysis patients. The proportion of time devoted to the provision of pharmaceutical care for dialysis patients increased from 13.1% to 25.2% ($p<0.001$). Time devoted to clinical services and the provision of educational programs increased significantly, while the time allocated to distributive activities decreased by almost 20%. The number of pharmacists who provided pharmaceutical care for ambulatory dialysis patients increased significantly from 10 to 33 after completion of the program. Almost 70% reported that the mean hematocrit level of their patients increased, while 45% stated that the erythropoietin dose was lower after they began to intervene. Over 75% and 50% indicated that parenteral iron usage and serum iron stores were increased, respectively. An increase in patient compliance with phosphate binder therapy was reported by 73.3% and a drop in serum phosphorous was noted by 40%.
CONCLUSIONS: Participation in the NPCP program was associated with a reduction in distributive activities and increased clinical and educational activities. The delivery of pharmaceutical care to dialysis patients was enhanced and patient laboratory outcomes were improved.

380. Nephrology education components of United States Pharm.D. curricula. *Gary R. Matzke, Pharm.D., FCP, FCCP*, Alicia C.M. Alexander Cadogan, Pharm.D., Karen Korch, Pharm.D.; University of Pittsburgh, Pittsburgh, PA.

PURPOSE: The incidence of endstage renal disease has increased by 7-10% per year throughout the last decade. The pharmacotherapeutic needs of these patients are extensive; mean number of prescribed medications has ranged from 10-12. This survey was designed to quantify the scope and depth of renal pharmacotherapeutic educational offerings in the Pharm.D. programs of U.S. schools of pharmacy.
METHODS: A 32-item survey was developed to document the course topic areas and time allocations, the methods of learning and resources utilized by the faculty, and the means to assess student outcomes. Coordinators of renal courses were identified and interviewed by phone between September 1997 and February 1998.
RESULTS: The 47 course coordinators who participated were responsible for either an entry level (EL; n=21) or post B.S. program (PBS; n=26). Acute and chronic renal failure, dialysis, assessment of renal function, and drug-induced renal disease were incorporated in 75% or more of course offerings. The 8 (EL) to 10 hours (PBS) allocated to these topics constituted approximately 50% of the total time committed to the course. Drug dosing and acid base issues were addressed in less than 50% of courses. Lecture was the predominant method of instruction (50 ± 25.7% of time) followed by case presentations (25 ± 21.2%) and problem-based learning (17 ± 33.6%). Additional learning resources (e.g., Internet, videos) were utilized in less than 30% of the courses. Written exams were the predominant mode of student assessment (89.3% of the time); 65% of programs only used this modality of assessment.
CONCLUSION: The scope of nephrology course offerings and the time allotted to them has remained static during the 1990s (J Pharm Pract 1993;7:113). The offerings in EL and PBS programs were similar. Despite tremendous technologic advances and new educational paradigms, conventional/classic learning methods, resources, and modes of assessment are still extensively utilized.

381. Neurosurgery continuity of care pharmacy practice model. *Deepa Setty, Pharm.D.*; University of California San Francisco Medical Center, San Francisco, CA.

The clinical pharmacists on the inpatient neurosurgery service at the University of California San Francisco Medical Center have developed and implemented a unique and innovative continuity of pharmaceutical care practice model. In January 1998, pharmacists started participating in neurosurgery clinic by taking detailed medication histories prior to patients being admitted for surgery. The clinical pharmacists, pharmacy residents, and students perform overlapping functions with physicians on the inpatient neurosurgery service under a standardized protocol. Daily patient responsibilities include, but are not limited to, initiating, adjusting, changing, and discontinuing medications; electrolyte adjustment; ordering clinical laboratory tests; writing transfer orders; providing pharmacotherapeutic education to the residents, clinical nurse, specialists, and patients, as well as therapeutic monitoring of drug levels and reporting of adverse drug reactions. Pharmacists facilitate discharge by writing the discharge prescriptions, counseling the patient, and calling the discharge medications into a preferred pharmacy. All patients discharged are contacted within 72 hours of discharge to ensure they have received their medications and to resolve any medication-related questions. At discharge, patients are provided with a phone number to the clinical pharmacy office. The voice mail message provides an on-call 24-hour pager number to use in case of medication-related emergencies. Significant interventions and their impact in clinic, in the hospital, and post-discharge have been documented monthly. Data will be presented documenting the effectiveness of this continuum of care package which provides patients optimal pharmaceutical care.

382. The pharmaceutical care experience of the pediatric oncology service at Lucile Packard Children's Health Service at University of California San Francisco. *Helen Wu, Pharm.D.*, Sharon Youmans, Pharm.D., Ann Bolinger, Pharm.D., Abby Zangwill, Pharm.D., Steve Matsuoka, Pharm.D.; Lucile Packard Children's Health Services at University of California San Francisco, San Francisco, CA.

PURPOSE: Pediatric oncology patients often have complicated hospital courses due to the nature of the disease and polypharmaceutical therapy. A comprehensive clinical pharmacy program was instituted in March 1998 to optimize patients' pharmaceutical care and provide continuity of service.
METHODS: A total of 1.3 FTE clinical pharmacist positions are designated to provide pharmaceutical services to hospitalized and clinic pediatric oncology patients. In addition to daily patient care responsibilities, the pharmacists also institute and revise treatment-related guidelines to ensure optimal and cost-effective pharmaceutical care. The antiemetic guideline has been revised and a treatment guideline for fever/neutropenia will be established in the near future. To improve the pre-existing discharge process, the pharmacists developed a system to write patients' discharge prescriptions and facilitate medication provision. Patients with potential for encountering drug-related problems receive follow-up phone calls 48-72 hours after discharge.
RESULTS: The revised antiemetic guideline has had a 90% success rate in controlling emesis associated with moderate to highly emetogenic chemotherapy compared with 56% from the original guideline, and a cost savings of 10%. The evaluation of the newly instituted discharge program, and the preliminary data collected for a treatment guideline for fever/neutropenia also will be presented at the meeting.
CONCLUSION: The program provides continuity of care as patients move between clinic and hospital. The pediatric oncology department values the program and parents acknowledge and appreciate the pharmaceutical care efforts. The program will be continued based on its current success and evaluated for expansion in the future.

383. A clinical pharmacy-initiated program for managing high-dose methotrexate therapy in pediatric oncology patients. *John N. McCormick, Pharm.D.*, Lisa M. Stricklin, Pharm.D., Michelle H. Sanders, Pharm.D.; St. Jude Children's Research Hospital, Memphis, TN.

A comprehensive program for the therapeutic management of high-dose methotrexate (HDMTX) therapy in the pediatric oncology setting is presented. HDMTX with leucovorin rescue has been established as effective therapy; however, inappropriate management of these patients may lead to unacceptable toxicity or death. Clinical pharmacists at our institution have the responsibility for managing approximately 800 courses of HDMTX administration yearly. A multidisciplinary approach including clinical pharmacists, nurses, laboratory technicians, and physicians is employed. Clinical pharmacists serve as investigators with physicians in development of research protocols. After consultation with the physician, each patient is screened by a clinical pharmacist for renal or hepatic dysfunction, interacting medications, HDMTX history, and possible compliance problems. MTX levels are assayed in our department's accredited pharmacokinetics laboratory and a clinical pharmacist assumes responsibility for managing the patient and informing the physician of patient progress. The patient is seen by the pharmacist daily to document infusion tolerance, adequate hydration, urine output, proper timing of MTX levels, compliance with leucovorin rescue, and associated toxicity. Leucovorin dosage adjustments, fluid management, and subsequent MTX levels are recommended to the physician. Both a written and computerized record of each course is documented for future reference. We can document positive outcomes from this clinical pharmacy HDMTX management program. These include safe outpatient administration of HDMTX, cost savings because of decreased numbers of physician appointments, and decreased risk of hospitalizations and toxicity due to fewer cases of delayed MTX excretion and improved patient compliance. Clinical pharmacy management of HDMTX has become standard of care at our hospital.

384. An interdisciplinary approach for the evaluation of a new treatment for attention deficit hyperactivity disorder. *Karl D. Fiebelkorn, MBA*, William Pelham, Ph.D., Lisa Burows, Ph.D., Louise Cooper, M.S., Patricia Cotter-Grace, B.S., MLT, Cori Miklejn, B.S.; State University of New York at Buffalo, Buffalo, NY.

BACKGROUND: Attention deficit hyperactivity disorder (ADHD) affects 3-5% of school-aged children. Due to its short half-life, methylphenidate must be dosed at school. This presents administration problems while viewing the child as a social stigma by peers.
PURPOSE: To develop an innovative interdisciplinary program to train community pharmacists in the disease management of ADHD.
METHODS: Children with ADHD, aged 6 to 13, are recruited into a long-term phase III safety study involving a new sustained-released methylphenidate. After initial diagnostic screenings and baseline evaluations by physicians, subjects are assessed by clinical psychologists and pharmacists for drug effectiveness through the use of IOWA Conners (IC) Rating Scales, peer interaction assessments, and global evaluations by parents, caregivers, and teachers. Pharmacists measure pulse, blood pressure, height, weight, sleep quality, appetite, tic development and progression, concomitant medications, and adverse events. Patients are educated about the new dosage form and counseled regarding adherence, concomitant medications, and adverse events.
RESULTS: Eighty-three patients currently spend 15-20 contact minutes with pharmacists once per month. Initial patient outcomes have been favorable as shown by the IC and patient satisfaction surveys.
CONCLUSION: Preliminary results suggest that pharmacists are willing to participate in the clinical management of ADHD. The program will be expanded into a formalized certificate program and integrated with the professional experience training in our entry-level Doctor of Pharmacy program.

385. Clinical pharmacy practice in Saudi Arabia. *Abdullah A. Alghasham, Pharm.D.*, Milap E. Nahata, Pharm.D.; King Khalid University Hospital, Riyadh, Saudi Arabia; Ohio State University, Columbus, OH.

The College of Pharmacy, established in 1959, at King Saud University-Riyadh is the only college of pharmacy in Saudi Arabia. The pharmacy profession in the country has moved from being traditional, product-oriented to patient-oriented since the establishment of the department of clinical pharmacy in 1979. There has been a marked improvement in clinical pharmacy in Saudi Arabia in the past decade. Several modifications and improvements have been adopted in the pharmacy curriculum, and an M.S. program in clinical pharmacy was introduced in 1994 to prepare students to provide clinical functions. Pharmacy practice residency programs have been introduced in some hospitals. There have also been collaborations with U.S. universities and hospitals. Many Saudi pharmacists have been offered scholarships to obtain Pharm.D. degrees, and to participate in residencies, fellowships, and other training programs in the U.S. Currently, there are about 60 clinical pharmacists in Saudi Arabia, and 60% are Saudis. The activities of clinical pharmacists include patient care rounds; pharmacokinetic monitoring; therapeutic consultations; drug use evaluation; patient counseling and education; drug and poison information; adverse drug reaction reporting; teaching medical, pharmacy, and nursing staffs, and students; total parenteral and enteral nutrition, pharmacy and therapeutic committee membership; and research. Although clinical pharmacists are well respected in many areas of practice, they are expected to justify their positions in some places. The main challenges to clinical pharmacy in Saudi Arabia are to increase the number of clinical pharmacists and to offer clinical pharmacy services more widely than in a few major hospitals.

386. Physician response to clinical pharmacy services in a private practice setting. *Jeanette L. Altavela, Pharm.D., BCPS*, Linda Barbeau, B.S., Tom Sorrento, B.S., Katie Smeenk, Curtis E. Haas, Pharm.D., BCPS; ViaHealth, Rochester, NY.

PURPOSE: This study assessed the response of a private physician and physician assistant (PA) to a clinical pharmacist's suggestions (interventions) during the first two consecutive 10-week periods the pharmacist worked with them in their office.
METHODS: A clinical pharmacist began working in a private physician office 4 hours a week, reviewing patient's charts and leaving a consult note as needed. The charts reviewed were of a particular capitated population of patients who had an appointment in the next 1-2 weeks. The notes addressed drug therapy issues in general. The physician and PA reviewed the note just prior to the patient's visit. They documented their thoughts or actions about the issues in their dictated chart note and/or on the consult note. The pharmacist kept a computer log of all the interventions and responses.
RESULTS: There were 86 and 68 interventions during the first and second 10-week periods, respectively. Comparing the two periods, 53 (61.6%) versus 48 (70.6%) interventions were accepted. Seventeen interventions (19.8%) versus 6 (11.7%) were not accepted. Sixteen interventions (18.6%) versus 9 (13.2%) were not addressed. Three interventions from the second period (4.4%) have not been fully assessed yet.
CONCLUSIONS: Prior to this project, this private physician and PA had not had a clinical pharmacist involved in their practice. It appears that the acceptance rate of interventions is increasing, as well as an improved rate of the physician actually addressing the pharmacist's concerns during the patient's visit.

387. Clinical pharmacy services in a private family medicine practice. *Laura M. Borgelt, Pharm.D.*; Shenandoah University, Winchester, VA.

PURPOSE: Clinical pharmacy services in a private family medicine practice are described. Commonly, ambulatory care clinical pharmacists provide services in family practice residency programs; however, there are few pharmacists providing services in private physician practices.
METHODS: A clinical pharmacist was placed in a private family medicine practice consisting of five M.D.s, one D.O., and two P.A.s in September 1998 to perform clinical pharmacy services 2 days a week. The primary clinical services that have been implemented include development of a formulary to restrict samples and lower long-term costs, physician education, a quality assurance project in hyperlipidemia, patient consultations, chart reviews, and drug information. In November 1998, an asthma management program, developed for community pharmacies, will be provided to potentially 200 patients seen at the family medicine practice.
RESULTS: A full description of services will be provided to compare and contrast the clinical services of a pharmacist in a residency-based family medicine practice versus a private family medicine practice. In addition, participation and effectiveness of the asthma management program to date will be described.
CONCLUSION: Clinical pharmacy services in a private family medicine practice may prove to be similar to those commonly seen in residency-based family medicine practices. In addition, a community pharmacy-based asthma disease state management program should be effective when provided in a family medicine practice setting. Clinical pharmacy services in this private setting provide a unique opportunity to integrate community and family medicine. These services may offer new ideas and opportunities for ambulatory care clinical pharmacists.

388. Examining expectancy theory and drug therapy decision making in pharmaceutical care. *Keith D. Campagna, Pharm.D., BCPS*, Michael H. Newlin, Ph.D.; Auburn University, Auburn, AL; University of Central Florida, Cocoa, FL.

PURPOSE: This is the second stage of a larger study designed to examine the relationship between work motivation (according to Vroom's expectancy theory) and the model of drug therapy decision making (DTDM) in the delivery of pharmaceutical care. Previous work has established the taxonomy of performance levels and outcomes of importance to pharmacists. This study endeavored to assess the attitudes of pharmacists regarding variables proscribed in the theoretical model and identify important associations with levels of DTDM.
METHODS: A representative national sample of U.S. pharmacists was surveyed to measure work motivation variables and DTDM performance levels. The first variable (valence) measured pharmacists' attitudes regarding the desirability of previously established outcomes (e.g., professional respect, financial compensation, occupational security). The second variable (instrumentality) measured attitudes about the relationship between levels of DTDM performance and these same outcomes. The final theoretical variable (expectancy) measured attitudes regarding one's ability to perform at each of the four levels (submissive, corrective, consultative, prescriptive) described by the DTDM. Levels of DTDM were determined by percentage of time spent on representative activities.
RESULTS: Attitudinal levels of each of the theoretical variables (instrumentalities, expectancies, and valences) and associated levels of DTDM are presented.
CONCLUSIONS: The relationship between the response patterns and the model of work motivation in making drug therapy decisions is discussed. Demographic analyses for each variable are presented and interpreted. Implications for encouraging higher levels of drug therapy decision making (i.e., consultative and prescriptive) by pharmacists are addressed.

389. Radiofrequency laptop computers improve the process, quality, and timeliness of pharmaceutical care. *Joyce A. Gawron, B.S.*, Frank J. Massaro, Pharm.D.; The North Shore Medical Center, Salem Hospital, Salem, MA.

PURPOSE: To define, implement, and evaluate the use of radiofrequency laptops (RFLs) to provide pharmacists immediate access to patient-specific clinical data, drug information, and pharmacy computer system functions in patient care areas of a 260-bed community teaching hospital.
METHODS: RFLs were incorporated into existing clinical pharmacy practices to facilitate decision-making and expedite drug distribution. RFLs were used to review historical information, examine objective patient data, research drug information, and enter medication orders at the bedside. A post-implementation survey of pharmacists, nurses, and physicians measured perceptions of the impact of the new technology on pharmaceutical care.
RESULTS: RFLs provided pharmacists with fast, easy access to all patient medication information including allergies, demographics, and duration of therapy, across hospital admissions. This information was used to make clinical decisions and impact the outcome of care. Access to hospital information systems including laboratory tests and results allowed for on the spot, informed recommendations. RFL use also improved the drug distribution process. Order entry at the time of prescribing decreased central pharmacy workload, freeing pharmacists for other clinical projects, and

decreased turnaround time of newly prescribed and stat medications by bypassing order transmission to the pharmacy. The overall perception was that RFLs added value to existing clinical pharmacy services. During rounds pharmacists are now depended upon to provide recommendations based on immediate access to a large amount of information. Access to information and expedient order entry is well appreciated.
CONCLUSIONS: Pharmacists' use of RFLs in our institution has improved the process and quality of care, and the timeliness and visibility of pharmacy services.

390. Development and implementation of a clinical staff pharmacist practice model in an academic medical center. *Todd W. Nesbit, Pharm.D., BCPS*, Mary Beth Bobek, Pharm.D., Donna L. Capozzi, Pharm.D., Patricia A. Flores, Pharm.D., BCPS, Michael A. Militello, Pharm.D., David A. White, B.S., Morton P. Goldman, Pharm.D., FCCP, BCPS, Jack Lemanowicz, M.S.; The Cleveland Clinic Foundation, Cleveland, OH.

PURPOSE: To develop a clinical staff pharmacist (CSP) practice model that allows for the expansion of pharmaceutical care services to hospitalized patients.
METHODS: The department of pharmacy at the Cleveland Clinic Foundation, a 923-bed tertiary and primary care teaching facility, provided most patient care services via staff pharmacists and pharmaceutical care specialists (PCS). A representative task force was formed to evaluate existing departmental patient care services and to develop a plan to address unmet pharmaceutical care needs. Presently, staff pharmacists' primary responsibilities involve medication order screening and processing and the facilitation of drug distribution, while ensuring basic patient safety. The CSP position was designed to bridge the gap between the significant operational role served by staff pharmacists and the specialized clinical and educational role served by the PCS pharmacists within selected service areas. CSPs will work closely with mentoring PCS pharmacists to extend pharmaceutical care services within the institution and to address additional drug-related problems of hospitalized patients. A 40-hour didactic program, the Pharmaceutical Care Core Curriculum, was developed to prepare these practitioners for new roles and responsibilities. Examination processes were developed to ensure basic clinical competencies prior to implementation.
RESULTS: The CSP practice model will be piloted for 3 months. Quantitative and qualitative assessments of pharmacist recommendations will be performed using commercially available software (Clinitrend™) customized to meet institutional needs. In addition, patient, pharmacist, and physician satisfaction survey instruments have been designed and will be applied and evaluated.
CONCLUSIONS: To the extent that automation technology supports and enhances the order processing and distributive functions of the department, and the economic, customer satisfaction, and patient outcomes evaluations document value, the role of the CSP should continue to expand within the institution.

391E. Taking pharmacy to the outback of Australia: experiences of the flying pharmacists. *Amanda L. Sanburg, B.Pharm., Grad.Dip.Pharm., Grad. Dip. Cont. Ed.*; Sarah R. Anthoney, B.Pharm.; Port Augusta, Australia.

Presented at the Society of Hospital Pharmacists of Australia Conference, Hobart, Australia, December 11-13, 1998.

392. Pharmacy-doctor joint venture project in six local Norwegian communities. Kjell-Erik Andersen, Thor K. Jacobsen, Ingse Resberg, *Agnes H. Sollien, M.Sc.Pharm.*, Dagfrid Solum, Tone M. Magnem; Ås Apotek; Ski Apotek; Kolbotn Apotek; Drøbak Apotek; Nesodden Apotek, Norway.

Seven pharmacies in six communities in Southeast Norway have conducted a drug information and evaluation project in collaboration with local doctors in general practice. The project stems from a proposal from the Norwegian Association of Pharmacy Proprietors. The project is named ALIS (Apotek Lege Informasjons Samarbeid, or Pharmacy-Doctor Information Collaboration Program). The aim is to contribute to rational use of drugs in the region. The project took place in 1998. The participants are general practitioners in the area and pharmacists from the seven pharmacies. The program combines plenary sessions and group meetings. The doctors participate in group meetings in the pharmacies where their patients normally have their prescriptions dispensed. In the group meetings, pharmacist participation is normally restricted. The agenda of the 1998 ALIS program consists of three main topics: serum lipid lowering treatment, antimicrobial agents prescribing, and treatment of pain. The pharmacies provide prescribing statistics. Included on the agenda are several legal matters of common interest. Prior to the plenary sessions, participants receive a survey of relevant literature. The plenaries start with a short presentation by a pharmacist of local and national drug statistics followed by a lecture on the main topic by an external expert. The local prescribing statistics are submitted in a coded form. The experience is that doctors share their prescribing habits with colleagues in subsequent group sessions two weeks after the plenary session. The 1998 ALIS Program in the region was completed in November 1998 and results will be evaluated.

393. Implementing clinical pharmacy services through expansion of the pharmacy technician-to-pharmacist ratio. *Michelle R. Southern, M.S.*, Maureen R. Prather, Pharm.D., BCPP; Washington State Penitentiary, Walla Walla, WA; Pfizer, Inc.

PURPOSE: Washington State Penitentiary pharmacy services recognized a need for quality improvement above and beyond the traditional dispensing role for pharmacists. The Washington Board of Pharmacy was approached to increase the pharmacy technician-to-pharmacist ratio in the facility from 1:1 to 3:1, in an effort to expand clinical services.
METHODS: The Board of Pharmacy granted a 1-year pilot study to implement a clinical program while expanding the technician-to-pharmacist ratio. The pharmacy partnered with a clinical education consultant from Pfizer, Inc. to design and implement a medication education program to increase compliance in prison inmates with complicated chronic disease states. The initial target group was HIV-positive inmates, due to the high cost of maintaining patients with AIDS.
RESULTS: After 15 months, this program has shown success in increasing medication compliance and decreasing health complications and hospitalizations. As the pilot study came to a close, the Washington State law was changed and the technician-to-pharmacist ratio was expanded from 1:1 to 3:1.
CONCLUSIONS: The acceptance of this program by the inmates, medical staff, and administration has opened avenues to target other disease states. The future goal is to decrease overall health care costs by improving medication compliance through pharmacist interventions with inmates who have chronic diseases.

394. Is there a pharmacist in the house? Opportunities for pharmacy intervention within a visiting nurse association. *Darren M. Triller, Pharm.D.*, Laurie L. Briceland, Pharm.D., Nancy M. Waite, Pharm.D., Carol A. Furman, B.S.N., M.S., Robert A. Hamilton, Pharm.D.; Albany College of Pharmacy, Albany, NY; Visiting Nurse Association of Albany, Inc., Albany, NY.

PROGRAM OBJECTIVE: Due to shorter hospitalization stays, patients with higher acuity levels are discharged earlier, frequently requiring home health care services. Often, patients require numerous medications and may receive prescriptions and medications from multiple physicians and pharmacies. Many are homebound, never receiving direct pharmaceutical care (PC). As a result, these patients are at high risk for adverse drug events and other adverse outcomes. To address this situation, we developed PC services at a visiting nurse association (VNA).
PROGRAM DESCRIPTION: A 2-year post-doctoral clinical pharmacy fellowship based at a VNA was funded and precepted by the college of pharmacy. Office space was provided by the VNA, and the college of pharmacy supplied all technological resources necessary for a mobile PC practice. Initially, an in-depth retrospective analysis of the records of 2333 patients was undertaken to enhance pharmacist understanding of the VNA patient population and to identify risk factors for adverse outcomes. A system for pharmacist intervention on individual patients identified to be at highest risk for adverse events was then developed. Data were collected to subsequently measure the impact of the interventions on outcomes. Methods for communicating with patients, nurses, prescribers, and preceptors were developed. Other activities such as the provision of drug information, staff development, creation and provision of Pharm.D. clerkship rotations, and administrative duties are ongoing. The ability to interact with patients in their homes and to access previously unavailable patient data provides virtually unlimited opportunities for a pharmacist to improve patient care and perform clinical research in the home care setting.

395. The pharmacist's role in the management of mentally ill and chemically affected patients. *Angelo A. Ballasiotes, Pharm.D.*, Jeff L. Jennings, M.D.; Washington State University; Central Washington Comprehensive Mental Health, Yakima, WA.

PURPOSE: Individuals who have a dual diagnosis of substance abuse and a mental disorder are a difficult cohort of patients to treat. They have a high degree of recidivism and utilize a very large amount of community resources. To identify and effectively treat these patients, a multidisciplinary mentally ill and chemically affected (MICA) team was implemented in Yakima County, Washington.
METHODS: The MICA team is composed of a psychiatrist, pharmacist, two case managers, two chemical dependency counselors, and a therapist. Patients referred to the MICA team are referred through a jail screening process, acute care intervention, and referrals within the mental health system. All patients with psychiatric symptoms are initially referred to the pharmacist for the initiation of pharmaceutical care.
CONCLUSION: The pharmacist plays a key role in the MICA team and is responsible for development and initiation of the pharmaceutical treatment plan. The plan addresses target symptoms and takes into account other patient-specific information. Pharmacist's prescriptive authority, including that for controlled substances, is utilized to initiate appropriate pharmacologic therapy. The team psychiatrist evaluates the patient and reviews the pharmaceutical care plan. The pharmacist continues to meet with

the patient on a scheduled basis until target symptoms are resolved or under control. The unique approach of the MICA team affords rapid resolution to patient issues as they arise. The pharmacist is an active partner in the continuity of care for the patient and is always available to help assess and manage drug-related issues or problems.

396. A proactive approach to providing clinical pharmacy services: experience from a lung transplant program. *Lingtak-Neander Chan, Pharm.D.*, V. Theodore Barnett, M.D., Sally A. Steinhiser, B.S.N., M.S., H. Ari Jaffe, M.D.; University of Illinois at Chicago, Chicago, IL.

PURPOSE: To evaluate a proactive pharmaceutical care model to optimize pharmacotherapy in complicated patients with high potentials for drug interactions.
METHODS: The clinical pharmacist is a member of the lung transplant team and is responsible for the pharmacotherapy of all inpatients and outpatients. The goals include facilitating therapeutic decisions to optimize therapy and cost savings, early identification of drug interactions, providing patient education, ensuring patient compliance, and implementing research. At the clinic, patients are seen by the attending physician, nurse practitioner, and the clinical pharmacist at the same time and therapeutic decisions are made together. Recommendations on drug-related issues are provided proactively. Patients are also encouraged to contact the transplant pharmacist in case of adverse reactions, poor therapeutic responses, and initiation of new drugs. This includes off-hours and weekends. The clinical pharmacist may suggest appropriate adjustment of therapy or refer patients to the transplant physician for further management, including hospital admission if necessary.
RESULTS: All patients received extensive pharmacist interventions. Fifty percent of the patients initiated contact with the pharmacist on drug-related issues, including new drugs initiated by other physicians, and drug interactions were identified early. Patient and physician acceptance have been enthusiastic.
CONCLUSION: The proactive approach enhances pharmacist-patient interactions, facilitates decision making in therapy, and reduces confusions among health care providers and patients. In addition, it also encourages the patient to update and report other drug-related issues, including initiation of interacting drugs by nontransplant physicians. Adverse effects can be minimized or prevented. Currently, we are reviewing treatment outcomes, protocol revisions, and financial impacts.

397. Comprehensive kidney transplant pharmaceutical care services at a major transplant center. *Ivy Lee, Pharm.D., BCPS*, Stephen J. Tomlanovich, M.D., Clifton Louie, B.S., D.P.A., Daniel B. Dong, Pharm.D., Jocelyn Tom, Pharm.D.; University of California San Francisco Medical Center; University of California San Francisco Stanford Health Care, San Francisco, CA.

The development of comprehensive kidney transplant pharmaceutical care services is described. The program was developed to enhance the health and quality of life for individuals with kidney transplants by managing costs, providing continuous medication counseling, and maintaining continuity of care from hospital to home. The transplant pharmacist identified patient and pharmacy services necessary for a comprehensive pharmaceutical care program and developed a practice protocol with the transplant nephrologist. The medical center outpatient pharmacy was established as the supplier of post-transplant medications, providing additional pharmacy services such as delivery of discharge medications to the hospital unit, mail services for refills, and billing of insurance payers. The transplant pharmacist was responsible for providing patient-oriented services post-transplant, such as protocol medication management and patient education. Protocol medication management includes adjusting and discontinuing therapy for prophylaxis against cytomegalovirus, candidiasis, and *Pneumocystis carinii* pneumonia. A pharmacy office located near the transplant clinic allows the transplant pharmacist to conduct compliance and clinical monitoring through outpatient clinic visits, routine communication, and laboratory results. The pharmacist serves as a liaison to the outpatient pharmacy coordinating discharge medications during the patient's hospital stay and assisting in obtaining insurance coverage of medications. In addition, the pharmacist functions as a liaison to home care representatives to develop realistic and workable home care plans. Utilization of existing pharmaceutical resources enables the University of California San Francisco transplant program to provide comprehensive and seamless care for kidney transplant recipients. The transplant pharmacist plays an important role in providing direct and seamless patient care in this practice model.

398. The University of California San Francisco National Center of Excellence in Women's Health pharmacy residency program. *Ronald J. Ruggiero, Pharm.D.*; The University of California San Francisco, San Francisco, CA.

PURPOSE: A recent survey documented the lack of an adequate women's health curriculum in many schools of pharmacy in the U.S. Inadequate pharmacist training may be partially to blame for poor patient compliance with both oral contraceptives, resulting in unintended pregnancies, and estrogen replacement therapy or hormonal replacement therapy, which may interfere with osteoporosis and cardiovascular disease prevention. The University of California San Francisco National Center of Excellence in Women's Health (UCSF COE) recognizes the importance of developing specialists in women's health who can serve as leaders in efforts to advance women's health. These specialists can accomplish the goal of incorporating into health care curricula, across disciplines, the latest research and knowledge regarding women's health and develop innovative patient care programs.
METHODS: The UCSF COE and the department of clinical pharmacy have developed a women's health specialty pharmacy residency that is designed to meet the following goals: 1) training to provide proactive, specialized drug-therapy management skills to improve patient understanding, satisfaction, and continuance with proposed pharmacotherapy regimens; 2) exploration of a new role for pharmacists in the co-management of pharmacotherapies which can be reproduced with managed care and integrated group practice environments; and 3) training in research methodologies to participate in clinical trials and evaluate innovative clinical pharmacy services, and to improve the health of women of all ages from diverse ethnic and social backgrounds.
RESULTS: The value of the women's health pharmacist will be documented.

399. Women's health pharmacy practice residency: the first year. *Martha Stassinos, Pharm.D.*; University of California San Francisco, San Francisco, CA.

There are few women's health pharmacists and very few have had the benefit of specialized residency training dedicated to women's health care. The goal of this residency is to demonstrate the value the clinical pharmacist brings to clinical care, teaching, and research. It is expected that the clinical pharmacist versed in the issues of women's health can improve continuance with therapy, overall quality of care, patient satisfaction, and retention of patients by their current provider practice or group health care plan.
The women's health pharmacy resident must become knowledgeable in primary, endocrine, internal medicine, and reproductive medicine. Needs of an increasingly older female population require emphasis on menopause management, health promotion, and prevention of diseases such as osteoporosis and heart disease. The resident is an active and vital participant in ambulatory patient care at several clinic sites; evaluates safety of medications during pregnancy and breast feeding; co-manages contraceptive, perimenopause, and menopause patients; precepts medical and pharmacy students in co-management clinical activities; and teaches women's health portions of the school of pharmacy therapeutics course.
The resident designs and implements two projects that address menopause issues. A study, "Patient Compliance, Discontinuation Rates, and Causes of Discontinuation with Estrogen Replacement Therapy/Hormone Replacement Therapy", seeks to determine the focus for proactive pharmacist intervention. Evaluation of a model for collaborative co-management of menopause explores applications and outcomes to justify reimbursement for such services within the University of California San Francisco National Center of Excellence in Women's Health.

RESEARCH IN PROGRESS

These papers describe original research 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.

400. International survey on clinical pharmacy services: initial pilot. *Chris J. Cairns, M.S., M.R.Pharm.S.*, Francine Goodman, Pharm.D., BCPS; St. George's Hospital, London, United Kingdom.

401. Quality assurance of medication routines at a department of internal medicine. *Astrid Dyssegaard*; Copenhagen Hospital Corporation, Copenhagen, Denmark.

402. Quantification and distribution of pharmaceutical diagnoses in inpatient and outpatient settings. *David M. Hachey, Pharm.D.*, Rex W. Force, Pharm.D., BCPS, Charles D. Lawless, Pharm.D., Vaughn L. Culbertson, Pharm.D.; Idaho State University, Pocatello, ID.

403. A pilot study of venlafaxine's use in the treatment of diabetic peripheral neuropathy. *Christine A. Kaminski-Price, Pharm.D.*, Jose Rey, Pharm.D., BCPP, Steven Bowen, M.D.; Nova Southeastern University; Broward General Medical Center.

404. The effect of micronized fenofibrate on lipid profiles of patients converted from gemfibrozil. *Jim M. Backes, Pharm.D.*, Patrick M. Moriarty, M.D., Connie L. Bejan, L.P.N.; University of Kansas Medical Center, Kansas City, KS.

405. A new Texas institution's collection of outcomes from their anticoagulation group. *Timothy J. Hartman, Pharm.D.*, Donna E. Cook, Pharm.D.; Texas Tech University Health Sciences Center, Amarillo, TX.

406. Reviewing prescriptions for potassium-sparing diuretics by a practice

pharmacist: a cost analysis. *Julie D. Morgan, B.Pharm.*, David J. Wright, Ph.D., Henry Chrystyn, Ph.D., Bethan George, M.S., B.Pharm., Andrew C. Booth, M.B.; University of Bradford, West Yorkshire, United Kingdom.

407. Collaborative practice between a family practice clinic and an independent community pharmacy for the provision of pharmaceutical care to hypertensive patients. *Jennifer A. Santee, Pharm.D.*, James D. Hoehns, Pharm.D.; Greenwood Drug, Waterloo, IA; Northeast Iowa Family Practice Center, Waterloo, IA; University of Iowa, Iowa City, IA.

408. Identification of risk factors for hospitalization of patients with congestive heart failure receiving home nursing care. *Darren M. Triller, Pharm.D.*, Laurie L. Briceland, Pharm.D., Nancy M. Waite, Pharm.D., Carol A. Furman, B.S.N., M.S., Robert A. Hamilton, Pharm.D., Jeffrey Kennicutt, Pharm.D.; Albany College of Pharmacy; Visiting Nurse Association of Albany, Inc., Albany, NY.

409. Design of the study of cardiac risk intervention by pharmacists: a randomized trial of community pharmacist intervention on cardiovascular risk factor modification. *Ross T. Tsuyuki, Pharm.D., M.S.*, Jeffrey A. Johnson, Ph.D., Koon K. Teo, M.B., Ph.D., Margaret L. Ackman, Pharm.D., Rosemarie Biggs, B.Pharm., Andrew Cave, M.B., M.Cl.Sc., Wei-Ching Chang, Ph.D., Vladimir Dzavik, M.D., Karen B. Farris, Ph.D., Donna Galvin, B.Sc.Pharm., William Semchuk, M.S., Pharm.D., Scot H. Simpson, Pharm.D., Jeff Taylor, Ph.D., for the SCRIP Investigators; University of Alberta; Capital Health Region; Alberta Pharmaceutical Association; Edmonton, AB; Foothills Hospital, Calgary, AB; University of Saskatchewan, Saskatoon, SK; Regina Health District, Regina, SK, Canada.

410. Plasma zinc status and hair loss. *Gyöngyvér Soós, Ph.D.*, Anna Gergely, Ph.D., Marianna Kontrasti, Margit Kocsis; Semmelweis Medical University, Budapest, Hungary; National Institute of Foods.

411. Evaluation of topical antiinflammatory activity of curcumin in healthy human volunteers. G.J. Khan, B.Pharm., *M.N. Saraf, Ph.D.*; Bombay College of Pharmacy, Mumbia, India.

412. Information about rare diseases and orphan drugs: Theriaque-Orphanet websites connections. *C. Grevot*, C. Tollier, M.C. Husson; C.N.H.I.M., Paris, France.

413. Medication nonadherence and utilization of emergency services in a homeless population: a focused review. *Bella H. Mehta, Pharm.D.*, Martin R. Giannamore, Pharm.D., David A. Mott, Ph.D., Ruth E. Emptage, Pharm.D.; The Ohio State University, Columbus, OH; University of Wisconsin.

414. A trial of a community pharmacists pharmaceutical care program to improve drug therapy and health-related quality of life for elderly patients: introduction and preliminary results from the OMA project in Germany. *Almut Mueller-Jaeger*, Marion Schaefer; Humboldt University, Berlin, Germany.

415. Hypnotics, tranquilizers, and antidepressants use in elderly European hospital and nursing home inpatients: trends in France. *Bruno Seigle-Murandi*, Marie-Odile Decroix, Pharm.D., Ph.D., Laure Bodenan, M.D., Georges Zelger, Pharm.D., François Herrmann, M.D.; Yverdon-les-bains Hospital; University Hospitals of Geneva; University of Paris, Paris, France.

416. A retrospective study to determine the incidence of hypercholesterolemia in HIV-infected patients on protease inhibitors. *Amy M. Drabinski, B.S., MBA*, Bonnie D. Purdy, Pharm.D., Doug G. Fish, M.D., Peter J. Piliero, M.D.; Albany College of Pharmacy; Albany Medical College, Albany, NY.

417. Development of a therapeutic drug monitoring service for HIV protease inhibitors in an ambulatory care clinic. *Lori D. Esch, Pharm.D.*, Mark J. Shelton, Pharm.D., Ross G. Hewitt, M.D., Robin DiFrancesco, MBA, Gene D. Morse, Pharm.D., FCCP; State University of New York at Buffalo; Erie County Medical Center, Buffalo, NY.

418. Implementation and patient outcomes of an antimicrobial formulary utilizing pharmacodynamic principles. *Vikas Gupta, Pharm.D., BCPS*, Farah Hashemi, M.D.; Olympia Fields Regional Osteopathic Medical Center, Lombard, IL.

419. Impact of a pharmacy-implemented restriction policy for intravenous fluconazole on outcomes. *Jill S. Burkiewicz, Pharm.D.*, Karen A. Kostiuk, Pharm.D., B. Joseph Guglielmo, Pharm.D.; University of California San Francisco, San Francisco, CA.

420. Effects of increased vitamin B supplementation on homocysteine levels and vascular access events in hemodialysis patients. *Sonia Lin, Pharm.D.*, Geoffrey Sheinfeld, M.D., Jamie Finley, Pharm.D., Jose Arruda, M.D., Alan Lau, Pharm.D.; University of Illinois at Chicago, Chicago, IL.

421. Long-term effect of paricalcitol for the treatment of renal osteodystrophy in hemodialysis patients. *Somratai Ratisoontorn, Pharm.D., M.S.*, Sonia Lin, Pharm.D., Jamie Finley, Pharm.D., Celia Chretian, B.S.N., M.S., Jose Arruda, M.D., Alan Lau, Pharm.D., FCCP; University of Illinois at Chicago, Chicago, IL.

422. Changes in medication use following gastric restrictive surgery for weight reduction in class III obese patients. Julie English, B.S., *Margaret Malone, Ph.D., FCCP, BCNSP*, Ron Boutin, B.S., Sharon Alger, M.D., Lyn Howard, MBA; Albany College of Pharmacy, Albany, NY.

423. The value of pharmaceutical care plans in elderly nursing homes. *Chanthonrat Sitthiworanan, B.Pharm.*, David J. Wright, Ph.D., Jonathan Silcock, M.S., Simon Tweddell, B.Pharm., Ian Wong, Ph.D., Bethan George, M.S., Henry Chrystyn, Ph.D.; University of Bradford, West Yorkshire, United Kingdom.

424. Ongoing ginkgo study illustrates feasibility and cost efficiency of Internet data collection. *Rolf Martin, Ph.D.*; HR Herbs, Sherman, CT.

425. Use of levofloxacin versus ciprofloxacin for antimicrobial prophylaxis in peripheral blood stem cell transplant. *Shirley W. Wong, Pharm.D.*, Elizabeth S. Gray, Pharm.D.; Virginia Commonwealth University, Richmond, VA.

426. Randomized comparison between oral ondansetron and oral granisetron for moderately emetogenic chemotherapy. *Jon D. Herrington, Pharm.D., BCPS*, Lore Lagrone, B.S.N., O.C.N., Peter Kwan, Pharm.D., BCPS, Mark W. Riggs, Ph.D.; Scott & White Hospital, Temple, TX.

427. Comparison between intrapleural doxycycline and bleomycin for the treatment of malignant pleural effusions. *Jon D. Herrington, Pharm.D., BCPS*, Clinton E. Baisden, M.D., Mohammad H. Rajab, Ph.D., Christie C. Cummings, B.S.N.; Scott & White Hospital, Temple, TX.

428. Outcome assessment in cancer patients receiving $5HT_3$ antagonists in the prevention of chemotherapy-induced nausea and vomiting in the outpatient setting: a randomized, prospective, comparative trial. *Robert J. Ignoffo, Pharm.D.*, Monica Lee, Pharm.D., Susan Sauer, B.S.N., Debu Tripathy, M.D., Thierry Jahan, M.D., Nancy Hui, Pharm.D., Alex McMillan, Ph.D.; University of California San Francisco, Mt. Zion Cancer Center, San Francisco, CA.

429. Methotrexate concentration in cerebrospinal fluid of the space created by tumor removal increases in parallel with dosage. *Norifumi Morikawa, Ph.D.*, Teruaki Mori, M.D., Hisanori Kawashima, B.S., Tatsuya Abe, M.D., Masaharu Takeyama, Ph.D., Shigeaki Hori, M.D.; Oita Medical University, Oita, Japan.

430. Clinical pharmacy interventions in Australia: a cost-benefit analysis. *Society of Hospital Pharmacists of Australia*; Royal Brisbane Hospital, Herston, QLD, Australia.

431. Pharmaceutical cost containment in the Portuguese National Health Service: room for therapeutic rationalization. *Francisco Batel-Marques, Pharm.D., Ph.D.*; University of Coimbra, Portugal.

432. Prevalence and associated direct drug costs of self-medication in Portuguese community pharmacies. *Nuno Cobrado, Pharm.D.*, Francisco Batel-Marques, Pharm.D., Ph.D., Margarida Caramona, Pharm.D., Ph.D.; University of Coimbra, Portugal.

433. Cost effectiveness of cisplatin vs cisplatin plus vinorelbine in patients with advanced non-small cell lung cancer. *Francesca Venturini, Pharm.D., M.S.*, Sabrina Trippoli, Pharm.D., Andrea Messori, Pharm.D.; University of Southern California, Los Angeles, CA; Laboratorio SIFO di Farmacoeconomia, Firenze, Italy.

434. Prevalence and characteristics of herbal remedy use in Northwest Ohio. *Alisha Vassar*, Karen J. Martin, Pharm.D., Timothy R. Jordan, Ph.D., Shawn M. Fitzgerald, Ph.D.; University of Toledo; Mercy Medical Education Program, Toledo, OH; Kent State University, Kent, OH.

435. Evaluation of a 2-concentration sampling strategy for once daily aminoglycosides. *Heath R. Jennings, Pharm.D.*, Elizabeth A. Coyle, Pharm.D., George A. Davis, Pharm.D.; University of Kentucky Chandler Medical Center, Lexington, KY; Detroit Receiving Hospital; Wayne State University, Detroit, MI.

436. Pharmacokinetics of midazolam and its main metabolite 1′OH-MDZ in patients during hypothermic status in the intensive care unit: a preliminary report. *Masayuki Hashiguchi, Ph.D.*, Morio Kaburagi, B.S., Keiko Kato, B.S., Tomoko Okuda, B.S., Miwa Yoshida, B.S., Toshimitu Nakayama, M.S. Pharm., Nariyuki Hayashi, M.D., Kousaku Kinoshita, M.D., Takashi Moriya, M.D., Akira Udagawa, M.D., Tadaaki Rikihisa, Ph.D.; Meiji Pharmaceutical University, Tokyo, Japan; Nihon University of Medicine Itabashi Hospital.

437. Impact of pharmacist delivered asthma education on quality of life. *Melissa A. Somma, Pharm.D.*, Patricia Klatt, Pharm.D., BCPS, Frank D'Amico, Ph.D.; University of Pittsburgh Medical Center-Presbyterian; UPMC-St. Margaret Family Medicine Residency Program, Pittsburgh, PA.

438. Improved patient outcomes following pharmaceutical care provided in a specialty care pediatric asthma clinic. *Paul J. Munzenberger, Pharm.D.*, Ricardo Z. Vinuya, M.D.; Wayne State University; Children's Hospital of Michigan, Detroit, MI.

439. Pharmacist intervention in outpatients with chronic obstructive pulmonary disease. *Lina Patel, Pharm.D.*, Reina Flores, Pharm.D.; James A. Haley Veterans Hospital, Tampa, FL.

440. Therapeutic outcomes monitoring of asthma patients: a community-based pharmaceutical care study in Hamburg, Germany. *Martin Schulz, Ph.D.*, Katrin Muehlbauer, B.S., Frank Verheyen, Ph.D., Elke Knop-Schneickert, Ph.D., Stephan Muehlig, Ph.D., Franz Petermann, Ph.D., Karl-Christian Bergmann, M.D.; Drug Information Center, Eschborn, Germany; University of Bremen; Allergy- and Asthma-Clinic, Bad Lippspringe, Germany.

441. The abuse of nonprescription medicines. Glenda F. Hughes, B.S., MPSNI, *James C. McElnay, Ph.D., FCCP, MPSNI, M.R.Pharm.S.*, Carmel M. Hughes, Ph.D., MPSNI, M.R.Pharm.S., Patricia McKenna, B.S., MPSNI; The Queen's University of Belfast, Belfast, Northern Ireland, United Kingdom.

442. Metoprolol metabolic ratio in premenopausal women. *Bettina A. Hamelin, Pharm.D.*, Caroline Sirois, B.S., Line Labbé, M.S., Sylvie Pilote, M.S.; Laval University, Ste-Foy, PQ, Canada.

443. Anomalous prescribing patterns of hormone replacement therapy. *Mahendra G. Patel, B.Pharm.*, Robert J. Naylor, Ph.D., D.Sc., Deirdre Naylor, Ph.D., Anne Hobbiss, Ph.D., Simon Grant, B.Pharm., Henry Chrystyn, M.Pharm., Ph.D.; University of Bradford, West Yorkshire, United Kingdom.

444. Age-gender differences post-myocardial infarction. Alan H. Heaton, Pharm.D., *Sara Jo Peterson, Pharm.D.*, Phong L. Pham, Pharm.D., Sarah A. Vanderlinde-Kuntz, Pharm.D.; Prime Therapeutics, Inc., Eagan, MN.

445. Concurrent use of cholinesterase inhibitors and anticholinergic agents in patients with Alzheimer's disease. *Scott Pollock, Pharm.D.*, J. Mark Ruscin, Pharm.D., BCPS, Jacci Bainbridge, Pharm.D., Robert Lee Page, II, Pharm.D.; University of Colorado Health Sciences Center, Denver, CO.

INTERNATIONAL CONGRESS ON CLINICAL PHARMACY ABSTRACTS

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