17TH ANNUAL MEETING ABSTRACTS

COMPARISON OF SYSTEMIC CORTICOSTEROID DOSING FOR THE TREATMENT OF PEDIATRIC STATUS ASTHMATICUS.
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Introduction: The National Institutes of Health released updated 2007 guidelines for diagnosis and management of asthma. One significant update lowered systemic corticosteroid dosing for inpatient status asthmaticus to 1-2 mg/kg/day (in 1-2 divided doses) of prednisone, prednisolone, or methylprednisolone (adult max 40-60 mg/day). Previous guidelines recommended 1 mg/kg/dose every six hours (adult max 120-180 mg/day) for 48-72 hours with subsequent reduction to 2 mg/kg/day (max 60 mg/day). Little evidence supports the most appropriate systemic corticosteroid dose; however, both efficacy and side effects must be balanced.
Purpose: Primary objective: determine impact of systemic corticosteroid dosing on inpatient length of stay for status asthmaticus/asthma exacerbation. Secondary objectives: determine impact of emergency department corticosteroid loading dose on inpatient length of stay, impact of corticosteroid dosing on need for escalation of care (pediatric intensive care unit [PICU] transfer, subcutaneous epinephrine or terbutaline, intravenous magnesium, or increased corticosteroid dose), asthma re-admission rate within one month of discharge, and rate of discharge on controller medication.
Methods: IRB-approved retrospective chart review of pediatric patients admitted for status asthmaticus or asthma exacerbation (ICD-9 billing codes) from October 1, 2007 to March 31, 2008. Inclusion criteria: admission to general medicine or pulmonary services and age ≤ 18 years. Exclusion criteria: direct PICU admission, pregnancy, cystic fibrosis, bronchopulmonary dysplasia, bronchiolitis, chronic systemic corticosteroid use, significant co-morbidities (tracheostomy, neurologic compromise), or home oxygen use. Demographic, asthma history, acute treatment, outcome, and adverse effects data were collected. Initial steroid dosing was categorized as high-dose (4 mg/kg/day), medium-dose (2 mg/kg/day), or low-dose (1 mg/kg/day). Emergency department steroid dosing was categorized as: no steroid, 1 mg/kg, 2 mg/kg, and capped dose. Results were analyzed using ANOVA, two sample t-test, chi-square test, and Fisher's Exact test.
Results: The study included 222 patients. Mean length of stay (days) was shortest in the low-dose group (1.78 ± 0.87), followed by the medium-dose (1.90 ± 1.26) and high-dose (2.53 ± 1.29) groups (P=.034). The difference was not significant after covariant adjustment. Mean length of stay (days) was shortest with emergency department dosing of 2 mg/kg (1.66 ± 0.8), followed by 1 mg/kg (2.04 ± 1.09), no steroid (2.11 ± 1.28), and capped dose (2.66 ± 1.65) (P<.001). Thirty patients required escalation of care. The low-dose group required more escalation of care which trended towards significance (P=.051). Asthma readmission rate within one month of discharge was 1.35%. 83.8% of patients were discharged on an inhaled corticosteroid-containing regimen.
Conclusions: Length of stay was similar among steroid dosing groups; however, patients in the low-dose group trended towards requiring more escalation of care. Prescribers' perception of asthma severity could not be determined. Further study is needed to evaluate severity-driven corticosteroid dosing as well as blinded corticosteroid dosing for status asthmaticus.

EVALUATION OF ERTAPENEM VS. PIPERACILLIN/TAZOBACTAM IN PEDIATRIC PATIENTS WITH PERFORATED APPENDICITIS.
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Objective: To confirm our hypothesis that there is no clinically significant difference between treatment of perforated appendicitis in

pediatric patients with ertapenem vs. piperacillin/tazobactam with respect to length of stay. **Background:** Ertapenem is a carbapenem with broad-spectrum activity. Ertapenem has good coverage against gram negative and positive aerobes, and anaerobes. Its Pseudomonal coverage is limited, which is presumed to be advantageous for delaying the development of Pseudomonal resistance in our institution. Ertapenem is FDA approved in pediatric patients 3 months and older. Administration is convenient with once-daily dosing or twice-daily in children <12 years old. It is endorsed by both the Infectious Disease Society of America and Surgical Infectious Society for use in community acquired intra-abdominal infections. **Methods**: Retrospective chart review of patients at The Children's Hospital, who received ertapenem or piperacillin/tazobactam for a perforated appendicitis between dates July 1, 2006-June 30, 2007. **Results**: One hundred and sixteen pediatric patients with a perforated appendicitis were included in our retrospective review (n=75 ertapenem, n=41 piperacillin/tazobactam). In both groups, the baseline patient demographics and patients with complications at admission were well-matched. The median length of stay in both groups was 6 days (P = .3). There was no statistical significant difference between treatment groups for any of our secondary outcomes such as number of days NPO, number of days fever > 38.3, number of days on antibiotics, WBC at admission and discharge, adverse reactions, complications post-operatively, hypotension, intervention required, readmission rate within one month and cost of therapy. **Conclusions**: No statistically significant (P=.3) difference in length of stay when pediatric patients received either ertapenem or piperacillin/tazobactam for perforated appendicitis. Ertapenem is non-inferior to piperacillin/tazobactam for treating pediatric patients with a perforated appendicitis; therefore our institution will continue using ertapenem as the drug of choice for perforated appendicitis due to cost and ease of administration.

PREVALENCE OF DAPSONE-RELATED METHEMOGLOBINEMIA IN PEDIATRIC ONCOLOGY PATIENTS. Bains T, Ramphal R, Pattar R, Philippe A. Children's Hospital of Eastern Ontario, 401 Smyth Rd., Ottawa, K1H8L1, Canada; email: epascuet@cheo.on.ca

Introduction: Dapsone is a widely used antibiotic for a variety of conditions including the prophylaxis of *Pneumocystis jiroveci* (formerly *carinii*) pneumonia (PCP) in immunocompromised oncology patients. A known adverse effect of dapsone use is methemoglobinemia, reported most often after an over dosage but also in patients on prophylactic doses. Symptomatic methemoglobinemia can present as persistent anemia requiring red cell transfusions, cyanosis and hypoxia. Although clinical symptoms of methemoglobinemia can present at levels of 15%-20%, increasing levels can lead to metabolic acidosis, cardiovascular instability, or even death. Pediatric oncology patients are likely to become symptomatic at much lower levels of methemoglobin, in view of their chronic anemia. Also, a significant proportion of these patients are subjected to general anesthetics (i.e., benzocaine, lidocaine) for various procedures, which are known to increase the risk of methemoglobinemia.
Methods: A retrospective chart review was conducted to determine the prevalence of methemoglobinemia in pediatric oncology patients at the Children's Hospital of Eastern Ontario. Subjects were <18 years of age and were receiving Dapsone as prophylaxis against *Pneumocystis jiroveci* pneumonia. Data was collected on 26 patients receiving Dapsone, at a dose of 4 mg/kg administered once weekly.
Results: Results are based on preliminary evaluation of the data collected from October 2006 to October 2007, whereby 23 pediatric oncology patients on Dapsone prophylaxis had documented methemoglobinemia. The remaining 3 patients did not have any methemoglobin levels monitored and have since had their Dapsone discontinued. Although the majority of the cases were asymptomatic with methemoglobin levels <10%, all 23 cases had peak methemoglobin levels above 2%, the upper limit of normal. Nine of the 23 patients were symptomatic, defined as the presence of cyanosis and/or oxygen saturations < 95%. Six of the 23 patients required admission to hospital for methemoglobinemia and treatment with supportive care and/or Methylene blue. Three

of the 23 patients received Methylene blue therapy. The decision to treat with Methylene blue was based on the patient's methemoglobin level and their clinical status. G6PD deficiency was excluded in symptomatic patients. Dapsone therapy was discontinued when: (1) methemoglobin levels > 5% (n = 19); or (2) other reasons and/or are now deceased (n = 4).
Conclusions: These results have important clinical implications regarding the ideal choice of drug for prophylaxis of PCP in pediatric oncology patients. Guidelines for the monitoring of Dapsone-associated methemoglobinemia have been developed at our institution. In view of the extensive use of Dapsone worldwide for a variety of disorders including leprosy and dermatological conditions, patients receiving Dapsone should be closely monitored for methemoglobinemia. The results of this study should prompt further research into the pharmacogenetic risk factors (heterozygosity for NADH-dependant Cb5R deficiency) for Dapsone-induced methemoglobinemia in the pediatric oncology population.

EDUCATION OF NURSING STAFF INCREASES THE UTILIZATION OF ELECTRONIC DRUG INFORMATION RESOURCES. Vaillancourt R, Hollis K, Hilliard J, Adams C, Chartrand E, Mulholland B, Lenz L, MacNeil J, Wong E. Children's Hospital of Eastern Ontario, 401 Smyth Rd., Ottawa, K1H8L1, Canada; email: epascuet@cheo.on.ca

Background: Several on-line drug information resources have been available for use to our institution's nursing staff for the past two years. A survey of the nursing staff in August 2007 revealed that utilization of electronic resources has been limited by lack of computer access and lack of familiarity with the resources themselves. Our project was part of a late career nurse funding initiative by the provincial Ministry of Health of Canada.
Objective: To increase the utilization of available electronic resource material by the ward nurses.
Method: Two pharmacists and a nurse educator trained two nurses from a pediatric medicine unit on the use of on-line resources. These nurses are responsible for training about 130 ward nursing staff. Utilization of on-line Lexi-comp, Patient Advisory Leaflets (PALs) and the electronic parenteral drug manual was monitored before and after the teaching to assess the impact of the education program. The staff completed utilization surveys regarding their use of drug information resources before and after the education program.
Results: During the implementation phase 70 nurses were trained. Access to PALs has increased by 380%, to Lexi-comp by 174% and to the parenteral manual by 18.6% from September to March 2008. The results of the survey will be available upon completion of the validation phase.
Discussion: To date the project has been well received by the nursing staff and has increased their use of available electronic resources. Increasing access to electronic drug information resources has the potential to decrease errors related to medication administration thereby increasing patient safety.
Implications for policy: Increased utilization of the PALs system will ensure that the pediatric patient and their families are informed and educated on the medications that they are receiving while in hospital and upon discharge.

THE IMPACT OF SURFACTANT ON INDOMETHACIN PHARMACODYNAMICS IN PREMATURE NEONATES. McPherson C, Gal P, Richter S, Ransom JL, Wimmer JE, Carlos RQ, Dimaguila MA, Smith M. The Women's Hospital of Greensboro, 801 Green Valley Road, Greensboro, NC 27408, United States; email: ccm0145@bjc.org

Objective: Indomethacin (INDO) is proven effective for pharmacologic closure of the patent ductus arteriosus (PDA) in premature infants. Initial dosing guidelines were developed prior to the availability of surfactant. We observed a trend toward needing higher INDO concentrations for ductal closure after our center started using surfactant routinely for respiratory distress syndrome (RDS). Our large patient database now allows us to appropriately examine the effect of surfactant administration for RDS on INDO pharmacodynamics for PDA closure.
Methods: This is a 21-year prospective cohort study including 442 INDO treated patients given 466 INDO treatment courses. Demographic information and medications were recorded. The cohort included patients treated

with no surfactant, synthetic surfactant (colfosceril), and natural surfactant (beractant or calfactant). Patients with a PDA confirmed by echocardiography initially received INDO 0.25-0.3 mg/kg IV. INDO doses were infused over 1 hour with serum concentrations measured 2 hours and 8 hours after the dose. Subsequent INDO dosing was based on a combined pharmacokinetic/pharmacodynamic (PK/PD) approach. Before each dose, patients were assessed for response and toxicity to INDO. The relationship of the concentration to response and dose to response was graphed for the three surfactant treatment categories (none, synthetic, and natural). ANOVA was used to compare mean (SD) INDO closure concentrations between surfactant groups, with significance set at $P < 0.05$.
Results: PDA closure was successful in 405/442 patients (91.6%) and in 434/466 treatment courses (93.1%) using an individualized PK/PD dosing approach. Renal toxicity was documented in 56/442 patients (12.7%) or 56/466 treatment courses (12.0%). Patients not treated with surfactant had significantly lower mean INDO closure concentrations compared to patients treated with either synthetic surfactant (1.65 mg/L vs. 2.15 mg/L, $P<.001$) or natural surfactant (1.65 mg/L vs. 2.07 mg/L, $P<.002$). Models analyzed controlling for covariates of postnatal age, gestational age, birthweight, and 5-minute APGAR produced similar results. Differences in closure levels were also analyzed along the continuum of a pharmacodynamic concentration/response curve. An INDO concentration of 1.9 mg/L closes 70% of PDAs in patients with no previous surfactant therapy. To obtain a similar closure rate in patients treated with synthetic or natural surfactant prior to INDO therapy requires INDO concentrations of 2.25 mg/L and 2.7 mg/L, respectively. These differences in concentration correlate with an increased total dosing requirement of approximately 0.1 mg/kg and 0.3 mg/kg for patients treated with synthetic or natural surfactant, respectively.
Conclusions: Administration of natural or synthetic surfactant for RDS increases the INDO concentrations necessary for ductal closure in premature infants. Dosing guidelines established prior to the availability of surfactant would be expected to result in relatively poor response rates.

A COMPARISON OF INDOMETHACIN VERSUS IBUPROFEN LYSINE FOR THE TREATMENT OF PATENT DUCTUS ARTERIOSUS (PDA). Cies J, St. Christopher's Hospital for Children, 115 Brookview Lane, Pottstown, PA 19464, United States; email: jeffrey.cies@tenethealth.com
Introduction: The purpose of this study was to compare treatment outcomes between ibuprofen lysine and indomethacin for the treatment of PDA in an urban tertiary care facility that utilizes a treatment protocol that did not begin treatment within 72 hours of life.
Methods: This was a dual retrospective chart review and a prospective observational study. All patients who received at least one dose of indomethacin for the treatment of PDA from January 1, 2003–December 31, 2006 were included in the retrospective arm. All patients who received at least one dose of ibuprofen lysine for the treatment of PDA from January 1, 2007 – January 31, 2008 were included in the prospective observational arm. The primary outcome assessed was the number of successful PDA closures with each agent, where a successful closure was assessed via echocardiography. Secondary outcomes included incidence of chronic lung disease at 28 days, total days requiring oxygen therapy, incidence of spontaneous intestinal perforation/necrotizing enterocolitis, and total number of courses received. Assuming a closure rate of 80% for each agent with an $\alpha = 0.05$, a power of 80%, and a 10% confidence interval range, 81 patients would be needed in each group to detect a 10% difference in closure rate. Statistical analyses were conducted with SPSS version 15 (SPSS Inc, Chicago, IL). A chi-square or Fischer's exact test was used for categorical variables and a student's t-test was used for continuous variables.
Results: Baseline demographic data was similar between both treatment groups. Treatment with indomethacin resulted in PDA closure for 50 of 63 (79.4%) patients and treatment with ibuprofen lysine resulted in PDA closure for 16 of 31 (51.6%) patients, $\chi^2 = 7.651$, $P = .006$. Nine (14%) infants in the indomethacin group and 7 (23%) infants in the ibuprofen lysine group required surgical ligation. Forty-eight (76%) infants in the indomethacin group and 22 (76%) infants in the ibuprofen lysine group required oxygen support

at 28 days post-natal age. The mean number of oxygen therapy was 56 ± 37 days for indomethacin and 52 ± 28 days for ibuprofen lysine. There was no difference in the rate of NEC between treatment groups (4.8% in the indomethacin group and 9.7% in the ibuprofen group). **Conclusions:** Treatment with indomethacin resulted in a statistically significant higher rate of PDA closure when treatment was not initiated within 72 hours of life, which was part of the study protocol that gained ibuprofen lysine FDA approval. Depending on each institutions practice and use of NSAIDS for PDA closure, indomethacin may be superior to treatment with ibuprofen lysine.

A RETROSPECTIVE DRUG UTILIZATION EVALUATION OF VANCOMYCIN USE AND MONITORING IN PEDIATRIC PATIENTS, PART 1 OF 2. Bosley K, Yarberry B. Kosair Children's Hospital, 231 E. Chestnut St., Louisville, KY 40202, United States; email: kendra.bosley@nortonhealthcare.org

Objective: The goal was to evaluate the use, dosing, and monitoring of vancomycin in pediatric patients to identify potential obstacles to the optimization of vancomycin therapy. **Methods**: A retrospective drug utilization evaluation was performed on all patients at a pediatric hospital who received intravenous vancomycin from April 1 trough June 30, 2007. The data collected included length of therapy, dosage regimens, serum vancomycin troughs (including values and corresponding dose), microbiological data, indication for therapy, and de-escalation when appropriate. **Results**: A total of 302 courses of vancomycin were administered during the study period. The average length of therapy was four days (range 0 to 56 days). The most common initial dosage regimen prescribed was 15 mg per kg per dose every eight hours. The resulting median trough was 9.3. Based upon trough levels with a goal of 10 to 20 mg/L, 65.6% of courses initially needed a dosage adjustment and in 70.6% of those cases, a dosage adjustment was made. Of the 187 courses that were three days or less in length, 59.4% had troughs drawn. Based upon microbiological data & indication for therapy, de-escalation was appropriate in 28.1% of courses and occurred in 77.6% of those courses. Staphylococcus aureus was the most frequently isolated organism, followed by coagulase-negative staphylococci. **Conclusion**: The majority of courses of vancomycin administered were less than 72 hours in length and more than half of those had trough levels obtained. Upon further investigation, it was discovered to be a common practice for physicians to write for serum levels with the initial medication order. This finding resulted in the development of a protocol to allow pharmacists to order and manage serum vancomycin levels.

BACTERICIDAL PROPERTIES OF THE NOVEL PEPTIDE-CONTAINING SURFACTANT - SURFAXIN. Black C, Leon C, Pluim J. Discovery Labs, 2600 Kelly Road, Warrington, PA 18976, United States; email: jpluim@discoverylabs.com

Introduction: Surfactant protein B (SP-B), a member of the saposin-like family of proteins, has been shown to kill bacteria by permeabilizing bacterial membranes. Both native SP-B and synthetic peptides derived from native SP-B kill both Gram-positive and Gram-negative bacteria at low concentration (0.15-5.0 µM), though the antimicrobial activity of native SP-B is inhibited by surfactant phospholipids, whereas the synthetic SP-B derivatives appear to be more resistant to phospholipid inhibition[1]. The objective of this study was to investigate the bactericidal effects of Surfaxin (lucinactant; Discovery Labs), a wholly-synthetic surfactant that contains KL_4 (sinapultide), a 21-amino acid peptide that functionally mimics SP-B.
Methods: *E. coli*, *P. aeruginosa*, and *S. aureus* working bacterial cultures at a concentration of 10^4 CFU were prepared and incubated at 37°C in the presence of Surfaxin, Survanta (beractant; Abbott Nutritionals) as a reference comparator, 0.9% saline (control), or ciprofloxacin (positive control). Bacterial growth was assessed at 0, 5, 24, 48, and 72 hours.
Results: There was no growth in any test articles at T_0. For bacteria exposed to Surfaxin, there was no growth of *S. aureus* at any time point. There was limited growth of *E coli* at the 5 hour time point, but no growth at 24, 48, or 72 hours. With *P. aeruginosa,* there was limited growth through 24 hours and full growth at 48

and 72 hours. For bacteria exposed to Survanta, there was full growth of *E. coli* and *P. aeruginosa* at all time points, and limited growth of *S. aureus* at the five hour time point followed by no growth at 24, 48, or 72 hours. In the saline control there was full growth of *E. coli* through 24 hours and limited growth of *P. aeruginosa* through 48 hours, but otherwise no growth. In the ciprofloxacin controls there was no growth of any bacteria at all time points.

Conclusion: Surfaxin is bactericidal for both *E coli* and *S aureus*, but has only limited activity against *P aeruginosa*. In contrast, Survanta is bactericidal only for *S. aureus.* While the clinical relevance of these findings requires additional study, intratracheal administration of Surfaxin to preterm newborns may protect against pulmonary infection from both gram positive and gram negative organisms aspirated during birth.

SUCCESSFUL "RAPID EXTUBATION" TO N-CPAP FOLLOWING SURFACTANT REPLACEMENT THERAPY DOES NOT DEPEND ON SURFACTANT PREPARATION. Mazela J, Guardia C, Segal R. Discovery Labs, 2600 Kelly Road, Warrington, PA 18976, United States; email: jmazela@discoverylabs.com

Introduction: The practice of intubation, surfactant administration, and rapid extubation (InSuRE) to continuous positive airway pressure (CPAP) has been gaining popularity based on published observations, mainly in infants ≥ 27 wks post conceptual age (PCA). To date, clinical studies employing InSuRE using two animal derived surfactant preparations described time to extubation varying from several minutes to 9 hrs after surfactant replacement therapy (SRT). Recent studies suggest that using InSuRE may lead to shorter length of mechanical ventilation, and lower number of subsequent SRT doses. We hypothesized that success rates and outcomes employing rapid extubation after SRT would be similar among different surfactant preparations. The objective of this analysis was to compare the success and related outcomes of rapid extubation (within 6 hrs of life) following SRT with different surfactant preparations. Success of rapid extubation was defined as being alive without need for re-intubation and without presence of air leak at 7 days of life or being alive without bronchopulmonary dysplasia (BPD) at 28 days of life or 36 wks PCA.

Methods: A prospective analysis of historical data from the SELECT study (Moya Pediatrics, 2005) was performed. Infants who were alive and extubated within 6 hours of life were identified from this study population and analyzed by surfactant treatment group: Surfaxin, Exosurf and Survanta. Groups were compared using logistic regression analysis.

Results: A total of 137 infants were treated with Surfaxin, Exosurf, or Survanta and extubated within 6 hrs of life. The mean BW and GA in this population were 1041 ± 148 g and 29.4 ± 1.7 wks, respectively. Overall, the success of extubation at 7 days of life favored Surfaxin vs. comparator surfactants. There were no statistical differences among surfactants in success of extubation at 28 days of life and 36 wks PCA.

Conclusions: Rapid extubation following SRT can be successfully implemented regardless of the type of the surfactant used in RDS prophylaxis. The selection criteria, feasibility, safety, and benefit of the InSuRE technique must be established in prospective clinical trials.

CEFUROXIME AXETIL AND AMOXICILLIN/CLAVULANATE FOR STREPTOCOCCAL ACUTE OTITIS MEDIA: A META-ANALYSIS. Courter J, Lamb K, Girotto J. Connecticut Children's Medical Center, Pharmacy Department, 282 Washington Street, Hartford, CT 06106, United States; email: Jcourter@ccmckids.org

Background: *Streptococcus pneumoniae* is one of the most frequent bacterial causes of acute otitis media. Although there are data comparing amoxicillin or amoxicillin/clavulanate with cefuroxime axetil for treatment of acute otitis media, general outcomes data differ and no large studies specifically against *S. pneumoniae* exist. Therefore, a meta-analysis comparing these agents in patients with *S. pneumoniae* identified was performed.

Methods: A systematic literature of MEDLINE, EMBASE, International Pharmaceutical Abstract, and Web of Science were performed from the earliest possible date for each database through May 2008. Studies were eligible for inclusion if they were prospective

randomized controlled trials that compared outcomes of amoxicillin or amoxicillin/clavulanate to cefuroxime in children with acute otitis media due to *S pneumoniae*. The outcome evaluated was documented clinical failure or if measured bacteriologic persistence between 10-24 days after beginning antimicrobial therapy. Results are reported as relative risk (RR) with 95% confidence intervals and were calculated using a random-effects model. **Results:** A total of 364 patients were included in the meta-analysis from the three included studies. No studies comparing amoxicillin to cefuroxime were found. Dosage ranges of amoxicillin/clavulanate were between 40-60 mg/kg/day divided three times daily, whereas cefuroxime was consistently used at 30 mg/kg/day divided twice daily. Upon meta-analysis, there was no significant difference seen between the amoxicillin/clavulanate and cefuroxime regimens [RR 0.61; 95% CI 0.27-1.39; P = .24]. No statistical heterogeneity was observed between studies ($I^2 = 0\%$). As data in this field are limited, publication bias could not be assessed. **Conclusions:** Currently available literature suggests that the risk of bacteriologic failure due to *S pneumoniae* in acute otitis media is not significantly different for cefuroxime or amoxicillin/clavulanate (at the doses studied). Further trials using currently recommended high dose amoxicillin or amoxicillin/clavulanate that focuses on *S pneumoniae* outcomes are needed to further compare these antibiotic regimens.

DESCRIPTIVE STUDY OF PEDIATRIC ADVERSE DRUG EVENTS. Nydert P, Jebal Z, Lindemalm S. Karolinska University Hospital, Neonatology K78, Stockholm, 14186, Sweden; email: per.nydert@karolinska.se

Introduction: The purpose of this study was to describe the amount of identified adverse drug events (ADE) by a pediatric trigger tool, a retrospective chart review and the spontaneously reported ADE's and adverse drug reactions (ADR) at the Karolinska University Children's Hospital, Stockholm, Sweden. **Methods/design:** During the first three months of 2008 a random selected patient population of 20 children per month (0-18 years) with a hospital stay of more than two days were evaluated with the pediatric trigger tool developed by Institute of Healthcare Improvement. The selected patient population also underwent a non-standardized retrospective chart review to identify drug events not recognised by the trigger tool. From the electronic adverse event report database (HändelseVis) all drug associated events was extracted from the total population and compared with the extrapolated numbers from the selected population. This comparison was also made with the reports of the ADR's to the medical product agency. **Results:** During the three month study period 2068 children had a hospital stay of more than two days. Three (5%) of the randomly selected 60 patients presented 5 ADEs identified by the trigger tool and 11 (18%) of the patients presented 15 ADEs identified by the retrospective chart review. 19 (0, 9%) spontaneously reported events were classified as ADEs and 8 (0, 4%) ADRs in the total population. None of the identified ADEs in the selected population was seen in the spontaneously reported events. The maximum time for the trigger-tool was set to 20 minutes per patient, while the retrospective chart review was limited to the time it took to evaluate the chart, laboratory data and drugs (approximately 20-240 min/patient). The characteristic of the ADEs was related to the method used. Unexpected laboratory values, rashes and sudden withdrawal of drugs were typical findings with the trigger tool and the retrospective chart review. Most of the spontaneously reported events were made by nurses and subsequently the events were coupled to drug administration (80%). Reported ADRs were made by wards and doctors with a known interest and education in ADR reporting. **Conclusions:** To describe the ADEs at a children's hospital we can't only rely on spontaneous reporting. 0, 4-18% of the population experience ADEs depending on the method and the selected population. This shows the importance to use several different tools to identify medical errors and adverse drug reactions leading to ADEs. If using the more time effective trigger tool, the findings by the retrospective chart review should be used to create additional triggers. The ADEs will be monitored continuously and used in our patient safety practice and education to enhance the spontaneous reporting and reduce identified risks.

DOSE STANDARDIZATION OF ORAL LIQUID MEDICATIONS IN PEDIATRIC PATIENTS. Anderson A, Garlitz K, Hamlin A, Kuhn R. University of Kentucky Healthcare, Department of Pharmacy. 800 Rose Street, Lexington, KY 40515, United States; email: alande3@email.uky.edu

Objectives: The Joint Commission Sentinel Alert from April 11, 2008 recommends medication standardization as a risk reduction strategy to prevent medication errors in the pediatric population. However, weight-based dosing is the current standard of practice in pediatrics and there is limited data available on standardizing oral or intravenous medications to assist hospitals in implementing policies and procedures for dose standardization. The purpose of this study was to pool information from children's hospitals within the United States to obtain insight on implementation strategies devised by other hospitals regarding dose standardization, obstacles encountered by other institutions during the implementation process, and the actual medications standardized at each institution. **Methods:** This study retrospectively reviewed all oral medications in our children's hospital and identified the ten most frequently prescribed agents from August 2006 to 2007. A time and motion study was conducted to assess the number of doses prepared and the time required to prepare each dose. Additionally, a survey was developed and electronically submitted to children's hospitals affiliated with the Pediatric Pharmacy Advocacy Group. The primary endpoints include reduction of pharmacy workload and the number of individualized doses prepared. Secondary endpoints are decrease in cost, decrease in medication wastage, and increase in the number of doses recycled. **Results:** Data was collected over a 12 month period and the ten frequently used medications were selected to be standardized. The doses were standardized in increments of 0.05 mL or 0.05 mg assuring the dose is within the appropriate dosage range. The recommended standardized doses are comparable to examples from other institutions. One hundred and seven responses were received, 42.6% currently have policies on dose standardization whereas 57.4% of institutions do not. However, the majority of these institutions are planning to implement dose standardization within 1–2 years. The leading factor to implement dose standardization was preparation time (38.3% of responses). **Conclusions:** The Institute of Medicine and the Joint Commission recommends implementation of standardized processes for hospitals as a prevent strategy to decrease medication errors. However, there is limited data available regarding dose standardization of medications in the pediatric population as well as those processes necessary to implement dose standardization. The data obtained from the survey and examples of standardized doses from participating institutions assisted in the development of standardized doses of the ten frequently used medications at our children's hospital.

EDUCATION, INTEREST, AND CONFIDENCE OF PHARMD STUDENTS IN OHIO REGARDING PEDIATRIC PHARMACY PRACTICE. Koester J, Stephens J, Novak K, Lamberjack K. Nationwide Children's Hospital, Department of Pharmacy, 700 Children's Drive, Columbus, OH 43205, United States; email: Kimberly.Novak@Nationwidechildrens.org

Objectives: To characterize current pediatric didactic and experiential content of Doctor of Pharmacy programs in Ohio and to evaluate the students' interest in pediatric pharmacy and their level of confidence regarding pediatric topics. **Methods:** Surveys were distributed to universities in Ohio with established PharmD programs to assess the number of hours in pharmacy curriculum dedicated to pediatric topics, the type of topics covered, and the availability of pediatric pharmacy electives and rotations. In addition, an anonymous survey through Survey Monkey was emailed to students participating in the final two years of these PharmD programs. The student survey assessed confidence concerning pediatric specific topics, exposure to pediatric pharmacy topics (through electives, rotations, or internships), and interest and confidence in pursuing a pediatric career or residency. Descriptive statistics were performed for each question as appropriate for school and student surveys. The proportions of student survey

responses by year in school and amount of pediatric exposure were compared using either a Chi-square test or a Fisher's exact test. **Results:** A total of four colleges offering PharmD programs in Ohio responded to the survey and were included for analysis. The number of required classroom hours devoted to pediatric specific topics varied and included 12.25 hours, 18 hours, 20 hours, and 60 hours. One of four programs offered an elective pediatric course, and zero of four programs required a pediatric experiential rotation. Three hundred and ninety-five students from the four participating PharmD programs responded to the student survey. Ninety-five percent of students with one year of school remaining and 85% of students in their final year of school rated pediatric knowledge as important or very important. However, 97% with one year remaining and 87% in their final year were not confident or only somewhat confident regarding pediatric pharmacy topics. Fourteen percent of students expressed interest or extreme interest in pursuing a pediatric career, whereas 12% expressed equivalent interest in pursuing a pediatric specialty residency. Only 1% of students felt either well-prepared or extremely well-prepared for a pediatric-specific or intensive job and 4% felt similarly prepared for a pediatric residency. With increasing exposure to pediatric pharmacy, students were more confident regarding pediatric pharmacy ($P < .001$), felt more prepared ($P < .001$) to pursue a pediatric career/residency, and were more interested ($P <. 001$) in pursuing a pediatric career/residency. **Conclusions:** PharmD students understand the importance of pediatric knowledge but do not feel confident about their knowledge or prepared for pursuing a future in pediatric pharmacy. Based on the results of this study, an increase in pediatric exposure through pediatric electives, internships, rotations, and didactic instruction will help increase student interest and confidence regarding pediatric pharmacy.

EFFECTS OF ANTIPSYCHOTIC THERAPY ON BODY MASS INDEX AND BLOOD PRESSURE IN CHILDREN WITH NEUROBEHAVIORAL DISORDERS. Cowles B, Wing P. University of Rhode Island College of Pharmacy, 41 Lower College Road Fogarty Hall, Kingston, RI 2881, United States; email: bcowles@uri.edu

Introduction/Objective: The metabolic syndrome includes obesity, dyslipidemia, hypertension, and insulin resistance, which may increase the risk of type 2 diabetes and cardiovascular disease. In children, this risk may progress into adulthood. Medications such as the antipsychotic agents have been linked to the development of the syndrome. The primary objective of this study was to describe the effect of antipsychotic drug therapy on body mass index (BMI) and blood pressure in children from a neurodevelopmental specialty clinic. **Methods/Design:** Children who began treatment with an antipsychotic between 2000 and 2008 and maintained treatment for ≥ 3 months were eligible for this retrospective chart review. Baseline height, weight, systolic, and diastolic blood pressures (SBP & DBP) prior to antipsychotic use were collected from the medical record, as were data sets from each subsequent clinic visit. BMI was calculated and age-specific percentiles for BMI, SBP & DBP were determined. Average rates of change per month of treatment for BMI, SBP & DBP and the average absolute change in BMI, SBP & DBP percentiles were determined. The results were also stratified for specific agent, initial BMI, and age. **Results:** Data from 16 patients reflecting prescription activity from 2005-2008 were available for preliminary review. The mean age at the beginning of treatment was 135 months. The mean duration of antipsychotic treatment was 11 months. BMI increased at an overall average rate of 0.2 kg/m^2/month while SBP & DBP both increased at an average rate of 0.2 mmHg/month. The average absolute changes in BMI, SBP & SBP percentiles for the group were +5.3%, -0.3% and +1.8% respectively. Eight children maintained a BMI less than the 85th percentile for age during treatment; 2 patients' BMI progressed to greater than the 95th percentile for age while being treated with an antipsychotic. Aripiprazole

produced a greater rate of change of BMI than risperidone (0.4 vs. 0.1 kg/m^2/month). Children with a BMI < 85th percentile for age at the beginning of therapy showed a slower increase in BMI than children whose initial BMI was greater than the 85th percentile for age (0.1 vs. 0.3 kg/m^2/month). No difference in the rate of change of BMI was demonstrated for children ≤ 10 years of age compared with those > 10 years of age (0.2 kg/m^2/month). **Conclusions:** These preliminary data suggest a clinically significant effect of antipsychotic drug therapy on the BMI of children with neurodevelopmental and behavioral diagnoses. The impact on systolic and diastolic blood pressures was not as clinically significant. Careful monitoring of BMI and blood pressure of children receiving antipsychotic therapies should be encouraged in order to identify children at risk for the metabolic syndrome.

EXPERIENCE WITH CONTINUOUS INFUSION VANCOMYCIN IN HOSPITALIZED CHILDREN. VandenBussche H, Smit K. Bronson Methodist Hospital, 601 John Street, Kalamazoo, MI 49007, United States; email: ksmit20@gmail.com

Objectives: To evaluate the safety and efficacy of continuous infusion vancomycin in hospitalized children and to develop dosing and monitoring parameters for the use of continuous infusion vancomycin in this population. **Background:** Vancomycin is a glycopeptide antibiotic that demonstrates time-dependent killing. It is traditionally administered multiple times a day in intermittent infusions to treat gram-positive infections. Use of a continuous infusion may offer several benefits, particularly in children: constant serum drug levels, lower total drug requirements, fewer occurrences of red man's syndrome, and potentially lower costs. **Methods:** This was a retrospective, observational, descriptive study of patients less than 18 years of age who received continuous infusion vancomycin as inpatients from January 2004 to December 2007. Data collected from the medical record included demographics, comorbidities, vitals, select laboratory values, site of infection, vancomycin regimen, vancomycin levels, cultures and sensitivities, concomitant antibiotics and nephrotoxic medications, and adverse effects. **Results:** Ten patients (mean age 6 years) were included in the evaluation. Indications for vancomycin therapy included neutropenic fever (n=7), coagulase negative Staphylococcus bacteremia/catheter infection (n=1), osteomyelitis (n=1), and septic arthritis (n=1). The average vancomycin dose was 45 mg/kg/day and the average serum level achieved was 17 mg/L. Daily doses administered and levels achieved did not always correlate well with one another. The two patients receiving the highest daily doses (62 mg/kg/day and 69 mg/kg/day) achieved the lowest serum drug levels (9.4 mg/L and 12 mg/L). The average time to achieve desired serum levels was 1.6 days (n=7). Six patients were initiated on intermittent infusions and then transitioned to a continuous infusion. Two of these patients were switched to a continuous infusion because of an inability to achieve adequate serum drug levels on intermittent dosing. All patients improved clinically and those with positive cultures achieved sterility, either proven or presumed. Continuous infusion was well tolerated in all patients and no adverse events were attributed to vancomycin therapy. **Conclusion:** The use of continuous infusion vancomycin was well tolerated and achieved microbiologic and clinical success in the study population. Because of the small number of patients evaluated, it was not possible to draw firm conclusions regarding proper dosing and monitoring of continuous infusion vancomycin in hospitalized children. Vancomycin administered as a continuous infusion is an alternative to intermittent administration in children who are unable to achieve adequate serum drug levels with conventional dosing. Further evaluation of this dosing strategy is warranted, particularly in patients with enhanced renal drug clearance or in those requiring high vancomycin trough levels to treat complicated gram-positive infections.

EXTENT OF USE OF SALMETEROL, FLUTICASONE, AND FORMOTEROL AMONG U.S. CHILDREN AND ADOLESCENTS DIAGNOSED WITH ASTHMA, AND CONCORDANCE WITH TREATMENT GUIDELINES. Kelly B, Sclar D, Robison L, Skaer T. Washington State University, Yakima Valley Memorial Hospital Pharmacy Dept 2811 Tieton

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Background: As the most common chronic childhood disease, asthma presents an extensive burden to health care resources in the United States. However, the evidence base for pharmacotherapy in children is sparse. Management, like the nature of asthma, is multifaceted with strategies and challenges varying with age. Inhaled corticosteroids (ICS) target chronic inflammatory processes and are the mainstay of chronic asthma management despite earlier fears of long-term safety. Long-acting beta agonists (LABA) such as salmeterol and formoterol have played an integral role when ICS provide inadequate control. Sparked by the SMART trial in 2006, concerns over the safety of LABA have translated into modifications of treatment guidelines and class labeling warnings. This study investigated whether prescribing patterns correlate with changing recommendations of these medications in treatment guidelines. **Objective:** In June, 2007, the U.S. Food and Drug Administration (FDA) Pediatric Advisory Committee (PAC) reviewed data regarding the safety of salmeterol (risk of asthma related death) in children and adolescents. On November 28, 2007, the PAC reviewed additional safety information from the FDA Office of Surveillance and Epidemiology, and moved forward with updating the class labeling box warning. The present study was designed to address two of the questions posed by the FDA PAC. Namely, what is the extent of prescribing of salmeterol, fluticasone, and formoterol among U.S. children and adolescents diagnosed with asthma; and does prescribing correspond with treatment guidelines. **Methods:** Data were derived from the 2005 U.S. National Ambulatory Medical Care Survey (NAMCS) for children and adolescents aged ≤ 18 years and diagnosed with asthma. Analyses were performed using SAS (Release 9.1.3, SAS Institute Inc., Cary, NC, USA). Descriptive characteristics are presented as mean, or percent. Relative standard errors were calculated based on the methodology developed by the U.S. National Center for Health Statistics. **Results:** In 2005, there were an estimated 14,587,649 children and adolescents aged ≤ 18 years diagnosed with asthma. Of these, 1,530,976 (10.5%; 95% CI = 5.8% - 15.2%) were prescribed either salmeterol, fluticasone, or formoterol (7.9%, 87.1%, 5.0% respectively). Patients had a mean age of 12.5 ± 3.6) years, were 64.2% male, and 76.3% non-Hispanic white. 24.7% of patients were aged ≤ 12 years. **Conclusion:** Our findings indicate that in 2005, 10.5% of ambulatory U.S. children and adolescents diagnosed with asthma were prescribed either salmeterol, fluticasone, or formoterol. 24.7% of patients were aged ≤ 12 years; with 1.7% (6,318) prescribed either salmeterol or formoterol in contrast to treatment guidelines recommending use of these agents in persons aged ≥ 12 years. Further research is required to discern whether the risk/benefit ratio associated with these agents warrants their continued use in children and adolescents.

INFLUENCE OF HOME ASTHMA MAINTENANCE THERAPY ON FREQUENCY OF PEDIATRIC HOSPITAL ADMISSIONS.

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Introduction: Asthma is a chronic inflammatory disease characterized by wheezing, cough, and shortness of breath. According to the 2007 Guidelines for the Diagnosis and Management of Asthma: Expert Panel Report 3 (EPR3), an estimated 6 million children in the United States under the age of 18 are affected with asthma. Asthma is considered "controlled" when there are infrequent symptoms. In addition, adequate control reduces emergency department visits and hospitalizations and prevents reduced lung growth in children and progressive loss of lung function. The ERP3, 2007 update of the EPR2, continued to list inhaled corticosteroids (ICS) as the preferred maintenance treatment for asthma. Newer medications such as the leukotriene agonists (LTA) and cromolyn/nedocromyl are considered alternatives to low-dose ICS in mild-persistent asthma only. When asthma symptoms are not adequately controlled on ICS, LTA may be used in combination with ICS or long-acting beta agonists may be added

to ICS instead of increasing to high-dose ICS. **Objective:** The purpose of this study was to determine if a relationship exists between asthma maintenance treatment and hospitalizations for asthma in pediatric patients. **Methods:** Charts from patients admitted to the Batson Children's Hospital for asthma exacerbations were reviewed. Data collected included demographic information, home maintenance therapy, and prescriber specialty. **Results:** A total of 269 admissions were reviewed. Of those, 193 were eligible for analysis. Demographic data included 86 (45%) female and 149 African Americans (77%). Average age at admission was 5 years. Fifty-five percent of children admitted were on inhaled steroid therapy; 33% were on montelukast therapy; and only 6% were receiving montelukast as monotherapy. Thirty-nine percent were not on any maintenance therapy, however. Of the 63 children who had maintenance therapy prescribed by a community pediatrician, 67% were not on inhaled steroid therapy. In contrast, those seen by an University pediatrician, 66% (n = 131) did prescribe maintenance therapy that included an inhaled steroid. Ninety-seven percent (n = 37) of children seen by a pediatric specialist were on appropriate maintenance therapy. **Conclusion:** This data indicates that the guidelines are being followed by pediatric specialists for maintenance therapy as expected. However, it appears that community pediatricians are not regularly prescribing an inhaled steroid whereas University based pediatricians were more likely to prescribe appropriate maintenance therapy. Improper maintenance therapy may be one contributing factor to these hospital admissions and lends support to providing further education to both parents and general pediatricians.

SCREENING FOR PEDIATRIC HYPERTENSION IN THE EMERGENCY DEPARTMENT. Benson B, Laird L, Adcock K, Hogan S, Crout J, Dillard B. University of Mississippi, University of Mississippi Medical Center, Division of Pediatric Clinical Research, 2500 North State Street, Jackson, MS 39042, United States; email: kadcock@ped.umsmed.edu

Introduction: Since hypertension is thought to have its beginnings during childhood, pediatricians should be aware of the need for recognition and treatment of children with hypertension. According to The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents, hypertension is defined as an average systolic blood pressure and/or diastolic blood pressure that is greater than or equal to the 95th percentile for gender, age, and height on three or more occasions. Children over the age of 3 years who are seen in medical care settings should have their blood pressure (BP) measured at least once during every health care episode. For many children, especially in the medically underserved, emergency department (ED) visits may be the only medical care setting utilized. This possible lack of routine primary health care highlights the importance of identifying these elevated measurements at any possible health care interaction. The objective of this study was to determine the frequency of elevated BP measurements in a University Pediatric Emergency Department (PED). **Method:** A retrospective chart review of at least 3000 children presenting to the PED within a 6 week period from May-June 2008 will be completed. All patients that present to the PED within the appropriate time frame will be included in this study. Data collected for each patient includes gender, age, weight, ethnicity, chief complaint and blood pressure. Secondary endpoints include physician notation of elevated BP in the patient's chart, a discharge diagnosis of elevated BP, physician referral for a follow-up blood pressure visit, and whether the patient or the patient's parents were counseled concerning elevated BP. **Results:** To date, 1000 charts have been reviewed of which 502 did not have documented blood pressure measurements. Children less than three years of age accounted for 471 of those charts. Of the 498 documented BP measurements, 59.8% (298) were elevated while 40.2% (200) were normal. Only four charts had a notation by the physician referencing the elevated BP. Two patients were referred for follow-up visits with a specialist, two received education regarding BP elevation and one was discharged with a diagnosis of elevated BP. **Conclusions:** This study demonstrated that even in children who had BP measurements documented, identification of elevated mea-

surements was lacking as evidenced by the absence of repeat measurements, referrals for further evaluation or education about elevated blood pressure. This data indicates that the ED could be an appropriate environment to screen for pediatric hypertension, if obtaining blood pressure measurements and then recognizing elevations based on age, height and gender in children becomes more routine. This is especially relevant since an increasing number of children are receiving primary care in the ED.

INFLUENCE OF STANDARDIZED INFUSION CONCENTRATIONS ON PARENTERAL NUTRITION IN NEONATES. Eshelman J, Poppy A, Murphy M. The Children's Hospital, 13123 East 16th Ave, B375, Aurora, CO 80045, United States; email: Eshelman.Jennifer@tchden.org

Introduction: As part of National Patient Safety Goal 3B, the Joint Commission mandated implementation of standardized concentrations for continuous infusions by December 31, 2008. One concern many pediatric clinicians have with implementation of standardized concentrations is the perceived impact on total fluid allowance, and the possibility of limiting parenteral nutrition (PN) in neonates. **Methods:** To analyze both the perceived and actual impact of standardized continuous infusions on neonatal nutrition, a two-part study was performed. Part one consisted of a 14-question survey delivered to 76 pharmacists involved with neonatal care. Information gathered was used to summarize nationwide use of standardized continuous infusions and concerns surrounding their implementation. Part two of the study was a retrospective chart review of neonates at The Children's Hospital who received PN while requiring at least one standardized continuous infusion. Patients were included if they were between 1 and 14 days of life and receiving at least 80% of their caloric intake through PN. The primary nutritional outcome was the percentage of neonates receiving minimum macronutrient intakes to prevent catabolism and nutritional deficiencies (defined as: glucose infusion rate (GIR) of 8 mg/kg/min, 1.5 gm/kg/day of protein, 1 gm/kg/day of lipid, and 70 kcal/kg/day). Secondary outcomes included percent of patients achieving prescribed nutritional goals and percent receiving macronutrient intake to support growth (defined as: GIR of 10 mg/kg/min, 3.5 gm/kg/day of protein, 3 gm/kg/day of lipid, and 105 kcal/kg/day). **Results:** Thirty-five pharmacists responded to the survey and revealed that while 92% of the responding institutions were compliant with standardized concentrations, 11% were still concerned about the effect on neonatal nutrition. The retrospective chart review included 70 neonates (mean post-menstrual age 37 weeks, mean weight 2.61 kg), receiving an average of 2.1 continuous infusions per patient. The infusions occupied an average of 10% of total daily fluids with a greater percentage occupied by blood products, fluid resuscitation, and miscellaneous medications. Minimum GIR was generally achieved by day six of PN, mean protein and lipid intakes were above minimum recommended requirements throughout the course of the study, and mean caloric intake was above minimum intake by day five of PN. **Conclusion:** Standardized concentrations did not have a negative impact on the ability to provide adequate PN therapy in neonates at our institution. Since the minimum GIR was not met until day six of PN therapy, this study will be continued to further evaluate if the neonates were unable to tolerate higher glucose infusion rates, or if fluid and nutrition ordering practices need to be improved to provide more dextrose.

MULTIPLE CYCLES OF INTRAVENOUS IBUPROFEN LYSINE FOR PDA CLOSURE IN NEONATES. Pham K, Zauk A, Kiblawi F. St Joseph's Children's Hospital, 703 Main Street, Paterson, NJ 07503, United States; email: kathypham.pharmd@gmail.com

Background: Ibuprofen lysine is used to induce the closure of clinically significant patent ductus arteriosus (PDA) in premature infants. Primary literature has described the option of a second rescue treatment cycle or surgical ligation following initial treatment failure. Treatment approach among neonatologists and cardiologists can vary on whether to treat pharmacologically, surgically with ligation or conservatively by monitoring

for spontaneous closure. Repeated cycles of ibuprofen have been administered when the patient's clinical status was too unstable for surgical ligation. Our objective was to evaluate the efficacy of ibuprofen for PDA closure in neonates, determine the place in therapy of multiple cycles of ibuprofen, and identify patterns in patient factors for treatment success in a 50-bassinet level regional NICU. **Methods:** A retrospective chart review was conducted of all patients receiving ibuprofen lysine from August 2006-June 2007. Each cycle was given as a total of 3 doses spaced 24 hours apart, including a loading dose of 10 mg/kg and 2 maintenance doses of 5 mg/kg based on birth weight. The decision to treat with repeated cycles was made at the discretion of the neonatologist and pediatric cardiologist based on the clinical status of the patient. The primary outcome measure of efficacy was PDA closure based on post-treatment echocardiogram results. Secondary outcome measures included changes in serum creatinine at baseline and throughout treatment cycles. Demographic data including gestational age, birth weight, and age at start of each treatment cycle was also recorded. **Results:** Of the 29 patients included in the analysis, 19 post-treatment PDA closures occurred. Sixteen out of 29 cases closed after 1 cycle, 2 out of 29 cases closed after 2 cycles, and 1 case out of 29 closed after 3 cycles. Of the 18 patients with PDA closure, 1 had reopened after a successful second treatment. The PDA subsequently closed with another single treatment cycle. Gestational ages of patients with PDA closure ranged from 23 to 30 weeks with a mean and median of 26.6 and 26.5 weeks, respectively. Birth weight ranged from 475 to 1450 grams, with a mean and median of 851 and 855 grams, respectively. No clinically significant changes in serum creatinine from baseline were observed throughout each treatment cycle. Of the 11 treatment failures, 5 patients underwent surgical ligation. Time between treatment cycles ranged from 1 to 19 days with a median of 3 days. **Conclusions:** Our data suggests that the beneficial effects of ibuprofen for PDA closure diminish with each repeated cycle. No rise in serum creatinine was observed. Repeated cycles may be considered for those patients too unstable for surgical ligation but cost considerations must be made with regards to decreased likelihood of PDA closure with subsequent treatment cycles.

PHARMACOKINETICS OF VANCOMYCIN & GENTAMICIN IN PEDIATRIC PATIENTS ON EXTRACORPOREAL LIFE SUPPORT. Tam J, Ensom M, Kissoon N, Singh A, Cogswell A, Carr R. Children's & Women's Health Centre of British Columbia, Children's and Women's Health Centre of BC, Pharmacy Department, Room OB7, 4700 Oak St, Vancouver, BC V6H 3N1, Canada; email: jtam@cw.bc.ca

Background: Extracorporeal life support (ECLS), a form of cardiopulmonary bypass, may alter pharmacokinetics due to increased volume of distribution and drug adherence to circuit components. Vancomycin and gentamicin are commonly used antibiotics for prophylaxis and treatment of sepsis in these patients. However, there is little information describing the impact of ECLS on vancomycin and gentamicin pharmacokinetics or empiric dosing. **Objectives:** To characterize pharmacokinetics of vancomycin and gentamicin in pediatric patients on ECLS, compare intrapatient pharmacokinetics on and off ECLS, and create empiric dosing recommendations. **Methods:** Retrospective review of patients on ECLS at Children's & Women's Health Centre of BC from April 1999 to August 2007 who had at least two interpretable serum concentrations of either vancomycin or gentamicin. The Sawchuk-Zaske method was used to calculate pharmacokinetic parameters. **Results:** Median vancomycin pharmacokinetic parameters (n = 36) were: elimination half life (t1/2) 8.9 hr (1.4-47.5), volume of distribution (VD) 0.59 L/kg (0.22-1.64), and drug clearance (ClDrug) 0.06 L/hr/kg (0.01-0.13). Initial dosing recommendations per age group were: term neonates 15 mg/kg IV q 18 hr, infants 15 mg/kg IV q 12 hr, children 10 mg/kg q 12 hr, and adolescents 10 mg/kg q 8 hr. Median gentamicin pharmacokinetic parameters (n = 49) were: t1/2 8.1 hr (2.2-62.0), VD 0.62 L/kg (0.20-9.35), and ClDrug 0.06 L/hr/kg (0.02-0.34). Initial dosing recommendations per age group were: term neonates 5 mg/kg IV q 24 hr, infants 5 mg/kg IV q 24 hr, and children 4 mg/kg IV q 24 hr. Differences in

pharmacokinetic parameters on ECLS versus off ECLS (n = 12 for vancomycin; n=14 for gentamicin) were not statistically significant. **Conclusions:** Wide interpatient pharmacokinetic variability was observed. Longer dosing intervals of vancomycin and gentamicin are required to achieve target serum peak and trough concentrations. The pharmacokinetics on and off ECLS were not statistically significant likely due to small sample sizes. Further studies are required to describe pharmacokinetics on and off ECLS and to characterize drug disposition in ECLS.

TRANSFER RATES FOR SURGICAL LIGATION OF PATENT DUCTUS ARTERIOSUS FOLLOWING INITIAL TREATMENT WITH INDOMETHACIN VERSUS IBUPROFEN. Christensen C, Birge N, Stuva B, Anderson-Berry A. Creighton University School of Pharmacy and Health Professions, 2500 California Plaza Hixon Lied Science Building #117, Omaha, NE 68171, United States; email: cchristensen@creighton.edu

Introduction/objective: Patent ductus arteriosus (PDA) is a common complication of prematurity and a cause of significant morbidity. Traditionally, infants diagnosed with a PDA on echocardiogram have initially been treated indomethacin. Recently the Food and Drug Administration approved the use of ibuprofen lysine for closing a clinically significant PDA in premature infants. After changing the institutional formulary from indomethacin to ibuprofen, anecdotal evidence seems to suggest that infants who receive ibuprofen are transferred from our level IIIa Neonatal Intensive Care Unit (NICU) for surgical ligation at higher rates than those who received indomethacin. Our objective is to determine rates of transport for PDA ligation in NICU infants treated with ibuprofen versus indomethacin and to compare risk factors for unsuccessful medical closure of PDA. **Methods/design:** A computerized pharmacy database identified infants treated with ibuprofen over a 14 month period (July 1, 2006 to September 1, 2007). Infants treated with indomethacin in the 28 months (March 1, 2004 to June 30, 2006) directly preceding formulary change to ibuprofen were also identified. A retrospective chart review was conducted to collect patient demographics and transfer rates, as well as side effects and potential barriers to medical efficacy. Statistical analysis will be performed to compare transfer rates between treatments. **Results:** Fifty-five patients received indomethacin and 24 patients received ibuprofen in the respective timeframes. In the indomethacin arm, ten patients (18%) were transferred, while eight patients (33%) were transferred in the ibuprofen arm. Infants less than one kilogram and less than 28 weeks gestation at birth represented a majority of the transfers in both arms. It is notable that the infants in the ibuprofen arm had a lower mean weight (1037 grams versus 1330 grams). Seventeen additional indomethacin patients were discharged from the hospital with a clinically insignificant PDA compared to four in the ibuprofen group (31% compared to 17% respectively). Sixteen of the indomethacin patients also received indomethacin for intraventricular hemorrhage prophylaxis, including eight of the ten patients (80%) transferred. None of the ibuprofen patients received this prophylaxis. **Conclusions:** The preliminary data shows a potential increased rate of transfer for those patients receiving ibuprofen. This is possibly explained by the lower weight at time of treatment in the ibuprofen group.

TREATMENT OF NEONATAL ABSTINENCE SYNDROME: EVALUATION OF PHENOBARBITAL EFFICACY IN COMBINATION WITH EITHER METHADONE OR DILUTED DEODORIZED TINCTURE OF OPIUM AS STABILIZING AND TAPERING REGIMENS. HOME NOW, A PILOT STUDY. Leadbetter E, Cronin J, Osmer L. Eastern Maine Medical Center, 489 State St., PO Box 404, Bangor, ME 4401, United States; email: emma.leadbetter@gmail.com

Objective: Neonates exposed to drugs in utero are at risk of suffering from Neonatal Abstinence Syndrome (NAS). The primary objective of this study was to compare the length of treatment for two NAS regimens: phenobarbital plus methadone or phenobarbital plus diluted deodorized tincture of opium (dDTO). **Methods:** This was a randomized, prospective, open-label, non-inferiority trial conducted

in a ten-bed continuing care nursery and an eighteen-bed pediatric unit where approximately fifty NAS patients are treated annually. This study was approved by the IRB and written informed consent was obtained prior to participation. Neonates and parents were recruited from November 2007 through June 2008. All neonates greater than thirty-four weeks gestational age requiring treatment for NAS supplemental to phenobarbital were eligible for enrollment. Every four hours, nurses monitored each neonate with a modified version of the Finnegan scoring system. Neonates whose withdrawal symptoms were not controlled after an adequate phenobarbital load with maintenance dosing were then entered into the study. Enrolled neonates were randomized to either phenobarbital plus methadone or phenobarbital plus dDTO. The length of treatment was compared between groups using a Mann-Whitney test. Neonates with serious comorbidities, and those with any major congenital anomalies or genetic syndromes were excluded.
Results: From November 2007 to June 2008, nineteen patients met the study inclusion criteria, two patients were inadvertently not consented, three parents declined to participate in the study, and the remaining fourteen neonates (nine males, five females) completed the study. Of these, six were randomized to dDTO and eight to methadone. Overall, the total average length of treatment was 23 days with a range of 16 to 46 days. The average length of treatment was 23.16 days ± 8.5 days and 23.25 days ± 11.6 days for dDTO and methadone respectively (P=.846). No participants withdrew their initial consent and no neonates were transferred to a higher level of care, or required any additional medications due to adverse effects from treatment.
Conclusions: The length of treatment of NAS with phenobarbital and methadone is equivalent and not inferior to treatment with phenobarbital and dDTO. Methadone appears to be a safe and effective option for the medical management of NAS.

TREATMENT OF SEVERE COMMUNITY-ACQUIRED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS INFECTIONS IN A PEDIATRIC INTENSIVE CARE UNIT. Durham S, Benner K, Creel A, Winkler M. Samford University, 800 Lakeshore Drive, Homewood, AL 35229, United States; email: kwbenner@samford.edu

Introduction: In recent years, there has been an increase in the incidence of community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) infections. Our institution has seen a rise in severe CA-MRSA infections in otherwise healthy children that resulted in admission to the pediatric intensive care unit (PICU). The purpose of this study is to examine the initial antibiotic regimens prescribed, subsequent antibiotic alterations in response to culture results, and time to attain negative cultures.
Methods: A retrospective chart review was conducted to identify otherwise healthy patients who were admitted to the PICU with severe CA-MRSA infections during the past 6 years.
Results: A total of nine patients were identified for this study, all admitted to the PICU between March 2006 and September 2007. There were no patients identified for inclusion in the study before March 2006, further illustrating the recent rapid rise of this pathogen. The initial antibiotics prescribed were vancomycin (n = 8), cefotaxime (n = 6), piperacillin/tazobactam (n = 2), azithromycin (n = 2), clindamycin (n = 2), nafcillin (n = 1), and gentamicin (n = 1); 1 patient was prescribed only vancomycin initially, while all others received a combination of drugs. Antibiotics added later included rifampin (n = 7), clindamycin (n = 5), gentamicin (n = 5), linezolid (n = 4), vancomycin (n = 1), meropenem (n = 1), metronidazole (n = 1), doxycycline (n = 1), tobramycin (n = 1), nafcillin (n = 1), piperacillin/tazobactam (n = 1), and acyclovir (n = 1). Time to attain negative blood cultures ranged from 1 day to 11 days. The minimum number of antibiotics required to clear cultures was three. In four cases, six antibiotics were required, with one patient never obtaining negative cultures before death. The cases that required the most antibiotics to clear the cultures also took the longest amount

of time to clear the cultures. In two cases, blood cultures were cleared in one day, but these patients also required the least number of antibiotics. Appropriate dosing of vancomycin was utilized and therapeutic levels were obtained. There was an alarmingly high mortality rate of 33% in these nine patients as compared to an overall PICU mortality rate of <7%.
Conclusions: In this cohort of PICU patients with severe CA-MRSA infections, empiric broad spectrum antibiotic therapy was initiated, most often with vancomycin and at least one other agent. All patients required the addition of other antibiotics and most needed several days of therapy to obtain negative cultures. This data, combined with the high mortality rate for these patients, suggests that the initial choices for antibiotic therapy in otherwise health patients who present with severe CA-MRSA may be extremely important to the final outcomes and must therefore be carefully considered.

USE OF APREPITANT FOR PREVENTION OF CHEMOTHERAPY-INDUCED NAUSEA AND VOMITING (CINV) IN PEDIATRIC PATIENTS. Coppola D, Rodriguez V, Graner K, Gunderson H. Mayo Clinic, 4205 Crest Lane, Fort Lee, NJ 7024, United States; email: coppola.danielle@gmail.com

Background: The purpose of this study is to evaluate the role of aprepitant in the prevention of CINV among pediatric patients. While aprepitant has been shown to improve protection from acute and delayed emesis after chemotherapy in adults, dosing and effectiveness in pediatrics has not been systematically evaluated and only limited case reports exist.
Methods: This retrospective study evaluated the use of aprepitant in 33 patients < 18 years of age at Mayo Eugenio Litta Children's Hospital between November 2004 and March 2008. Dosing was evaluated for the entire group and age-related subgroups. Antiemetic response was recorded as number of episodes of vomiting and reported as complete, major, minor, or failed response. The percent of patients with complete or major response was reported for the entire group and defined subgroups.
Results: A total of 33 pediatric patients were evaluated for dosing. Aprepitant was dosed orally at approximately 2 mg/kg/dose initially, then 1.5 mg/kg/dose subsequently. The most common regimen utilized for patients < 40 kg was 80 mg on day 1, then 40 mg daily for 2 days. Thirty patients were evaluated for antiemetic response. Complete or major response was found in 76.7% of patients overall, with greater response in the acute CINV phase and strongest response in the delayed phase. Aprepitant was well-tolerated with only two cases of peripheral neuropathy considered attributable to drug interactions between the chemotherapy administered and aprepitant.
Conclusions: Aprepitant should be considered for addition to antiemetic regimens in pediatric patients receiving highly or moderately emetogenic chemotherapy.

UTILITY OF TRANSDERMAL FENTANYL FOR OPIOID WITHDRAWAL IN THE PEDIATRIC INTENSIVE CARE UNIT. Johnson P, Harrison D, Allen C, Hooper C. University of Oklahoma College of Pharmacy, 1110 North Stonewall Ave, Room 206, Oklahoma City, OK 73117, United States; email: Peter-Johnson@ouhsc.edu

Purpose: Fentanyl is a common agent used in the PICU for sedation and analgesia. Following prolonged administration, children may develop opioid abstinence syndrome (OAS) from abrupt discontinuation. At our institution, transdermal fentanyl (TF) has been infrequently used to prevent OAS in select children. The purpose of this retrospective pilot study is to 1) identify the number of intermittent narcotic doses administered for withdrawal symptoms in children (< 18 years of age) receiving transdermal fentanyl for OAS and 2) classify OAS symptoms.
Methods: Data was collected retrospectively from January 1, 2004 to December 31, 2007 and included demographics, continuous intravenous infusion (CII) fentanyl regimen, TF regimen, and OAS symptoms. The primary endpoint was the number of intermittent narcotic boluses utilized in children receiving TF for OAS. Secondary endpoints included the categorization of OAS symptoms and description of the TF regimen. Statistical analysis with Fischer's exact test, Pearson Chi-Square, and T-tests were used for data analyses with

statistical significance defined as $P < 0.05$. **Results:** Fifteen patients were identified. The median age (range) was 7 (0.3-17) and median Pediatric Risk of Mortality III score (range) 7 (0-21). CII fentanyl were continued for a median of 18.7 days (5.5- 42.1) with a median cumulative dose of 1356 mcg/kg (164.1- 9595.8). The median time to discontinuation of CII fentanyl following initiation of TF was 0.58 days (0.1- 1.2). The median initial dose of TF was 1.9 mcg/hr (0.4-6.1) with a median duration (range) of 16 days (5-27). To provide the desired dose, the TF patch was partially covered with tegaderm in eight patients. Eighty-six boluses were administered during TF therapy with 51 (59%) administered within 5 days of TF initiation. Ten patients had evidence of OAS, with the most common symptom being irritation/agitation. No significant differences between patients with OAS symptoms was observed between patients whose TF patch was covered versus not covered, 4 versus 3, respectively ($P > 0.05$). There was no correlation between narcotic boluses and OAS symptoms. **Conclusions:** The majority of patients in this cohort required additional narcotic boluses for OAS symptoms during the first 5 days of TF initiation. TF therapy cannot be recommended for routine prevention of OAS symptoms. This pilot study highlights future directions to standardize documentation and to educate clinicians on OAS symptoms.

IMPORTANCE OF DEVELOPING URINARY TRACT INFECTION TREATMENT GUIDELINES IN PEDIATRICS. Patel S, Maher A, Weld M. Children's Specialized Hospital, 293 Pinelli Dr, Piscataway, NJ 8854, United States; email: spatel@childrens-specialized.org

Introduction: 2007 infection surveillance indicates that in at least 50% of urinary tract infections (UTI) occurring at Children's Specialized Hospital (CSH), a more appropriate antibiotic could have been used for the treatment based on institution antibiogram. The objective of this study is to monitor antibiotic utilization and to determine the need for developing clinical guidelines for the treatment of UTI in infants and children at CSH. **Methods:** Beginning January 2008, a prospective antibiotic utilization for the treatment of UTI is being conducted in collaboration with infection control surveillance at CSH, a pediatric rehabilitation hospital. Data collection include antibiotic usage, urinalysis, culture and susceptibility report, and duration of treatment for patients with UTI (new or recurrent UTI) using a monitoring form. Patients' antibiotic treatment are evaluated utilizing available UTI guidelines in pediatrics and current CSH antibiogram. **Results:** Currently, seven patients with UTI have been evaluated. The data show that different antibiotics are being used as empiric treatment without consistency among prescribers. Three patients had no urinalysis performed prior to receiving empiric treatment. Six patients received appropriate antibiotic therapy based on culture and susceptibility, and the duration of therapy (mean 7 days) was consistent with the clinical guidelines. The data continues to be collected and final results are pending. **Conclusions:** Use of different antibiotics as empiric treatment can result in increase resistance and drug cost. Therefore, to guide appropriate empiric antibiotic treatment, UTI clinical guidelines were created and are currently being implemented.

DEVELOPMENT OF A COMPUTERIZED PEDIATRIC ANTICOAGULATION PROGRAM. Hilmas E. Alfred I duPont Hospital for Children, 104 John Street, Perryville, MD 21903, United States; email: ehilmas@nemours.org

Introduction: JCAHO requires that all organizations that provide anticoagulation therapy meet the requirements of National Patient Safety Goal (NPSG) 3E. Institutions are challenged to determine the best way to apply these goals in a pediatric inpatient and outpatient setting. A computerized heparin nomogram was developed and implemented at a large university hospital. This program helped prescribers order and monitor anticoagulation therapy using established guidelines for adult patients. The program has now been converted to a pediatric anticoagulation module (containing nomograms for heparin, enoxaparin, and warfarin) that can help pharmacists manage anticoagulation stewardship programs. **Background:** As mentioned before, the 2008

NPSG 3E provided the impetus for the development of this program. The goal focuses on the anticoagulants heparin, low molecular weight heparin and warfarin. Goals for the program and the timeline for implementation were clearly delineated by JCAHO with full implementation by January of 2009. NPSG 3E has eleven distinct components and the computer program addresses the majority of them. **Program Description/Methods:** A computerized dosing nomogram and monitoring sheet for each medication was developed, which assists with the complicated calculations required for dose adjustments in pediatrics. The 2004 Chest guidelines for antithrombotic therapy in children provided the clinical content for the program. This program was developed with insight from pharmacy and a Hematology physician/content expert. Computerized monitoring sheets that will be completed by the pharmacist are printed each time an order is placed. Safety features are built in such as dose limits, warnings, calculations, and use of dosing weight for obese patients and dose reduction for renal/hepatic dysfunction. Program was developed to coordinate efforts with programmable infusion pump drug libraries and standard concentrations for heparin. Finally, the program provides a method to evaluate anticoagulation safety practice by facilitating data collection. The program was developed over the course of 3 months. **Discussion and Conclusion:** Implementation of this program can help hospitals meet several of the requirements of NPSG 3E. The use of this program would help with standardization and would provide a venue to audit anticoagulation practices and thus improve patient safety outcomes. Computerized software solutions could provide a useful tool for pharmacist-run anticoagulation stewardship programs.

PHARMACIST-INITIATED MEDICATION RECONCILIATION IN A CHILDREN'S HOSPITAL. Lasak-Temme L, Englert L, Scarpace S. University of California San Francisco, 8 Locksley Avenue #1J, San Francisco, CA 94122, United States; email: llasak@gmail.com

Introduction: Medication reconciliation is the process of verifying and reconciling patients' medications upon admission with what the organization is currently providing to avoid medication errors and patient harm. Literature demonstrates that pharmacists are more accurate than physicians or nurses at reconciling medications in adult patients. However, there are no studies in the pediatric population. **Background:** At the UCSF Children's Hospital, physicians and pharmacists obtain separate medication histories. The pharmacy department interviews all patients within 24-48 hours of admission. Components of the pharmacist interview include: current/recently discontinued medications (including prescription and nonprescription medications, dietary supplements and herbal products), mother's medication history for breast-fed children and allergy history. Prescription information is reviewed with the patient's outpatient pharmacy. The information is verified by a pediatric pharmacist and documented in the electronic medical record. The UCSF Children's Hospital recognizes the pharmacist-generated medication list as the official source of medication information. **Program Description/Methods:** The objectives of this study are to evaluate the type and frequency of medication reconciliation discrepancies in the physician-generated admission medication list compared to the pharmacist-generated list and to determine if there is a difference in medication reconciliation documentation between pediatrician and surgeon-run services. The study is a retrospective chart review. Inclusion Criteria: pediatric patients (≤21 years of age) admitted to the UCSF Children's Hospital between September 1, 2007 and September 30, 2007 for >24 hours. Exclusion Criteria: patients not meeting inclusion criteria or without both pharmacist- and physician-generated admission medication lists. Electronic medical charts were reviewed. The physician-generated admission medication lists were compared to those of the pharmacist. Discrepancies were categorized into the following groups: prescription medication omissions, dose errors, and frequency errors; nonprescription medication omissions, dose errors, and frequency errors; extra medications. **Results:** There were 253 patients included in the statistical analysis. A total of 719 medication reconciliation discrepancies were found, with a mean of 2.84 discrepancies per patient. The mean number of discrepancies

per medication documented was 0.61 overall, with a mean of 0.54 in the physician group versus 0.92 in the surgeon group. Please refer to the tables below for a summary of results. **Discussion/Conclusion:** The study reveals that there are many discrepancies in the medication reconciliation documentation by physicians as compared to pharmacists. In addition, surgeons are almost twice as likely to inappropriately document admission medications as pediatricians. Medication reconciliation by pharmacists decreases opportunities for medication errors and the potential for patient harm in the pediatric population.

THE IMPACT OF PHARMACIST CREDENTIALING ON THERAPEUTIC DRUG MONITORING. Desai M, Johnson A, Chow J, Chicella M, Dice J. Children's Hospital of The King's Daughters, 601 Children's Lane, Norfolk, VA 23507, United States; email: michael.chicella@chkd.org

Objective: The Medication Evaluation and Data Service (MEDS) was initiated at the Children's Hospital of The King's Daughters in September 2006. All MEDS pharmacists applied for and were credentialed by the medical staff. Credentialing allows the MEDS pharmacist to control aminoglycoside and vancomycin dosing, therapeutic drug monitoring and related laboratory monitoring without physician authorization. Additionally, written documentation of the pharmacist's action(s) is incorporated into the patient's chart. Previously, all doses and levels were ordered by the physicians or physician extenders. All changes to therapy, and subsequent monitoring, were also ordered by the physician. The purpose of this study was to document the impact of pharmacist credentialing on therapeutic drug monitoring and on the cost of therapeutic monitoring. **Methods:** Two retrospective chart reviews were conducted. The first review occurred 6 months prior to pharmacist credentialing (group 1). The second review occurred 6 months after pharmacist credentialing (group 2). All orders for aminoglycoside antibiotics and/or vancomycin were included, as were all orders for therapeutic drug concentration monitoring. Eight-hundred fifty two orders were included in group 1 and 1,138 orders were included in group 2. **Results:** Group 1 had 541 levels obtained and group 2 had 454 levels obtained. With regard to aminoglycoside monitoring, 285 were obtained in group 1 and 298 levels were obtained in group 2. Although the number of levels ordered in group 2 were slightly more, the number of potentially inappropriate levels (example: peak concentrations in once-daily dosing) was less. With regard to vancomycin, 256 levels were obtained in group 1 and 156 levels were obtained in group 2. Significantly more vancomycin peak concentrations were monitored in group 1 as compared to group 2; 42 versus 7 respectively. The cost of therapeutic drug concentration monitoring for the 6 months prior to credentialing was approximately $70,000. The cost of therapeutic drug concentration monitoring after credentialing was approximately $59,000. Credentialing reduced the cost associated with therapeutic drug monitoring by 16% (approximately $22,000 annually). **Conclusions:** Clinical pharmacist credentialing allowed for a reduction in both the number of serum drug concentrations monitored and in inappropriate therapeutic drug concentration monitoring. Additionally, a reduction in cost associated with therapeutic drug concentration monitoring was observed after credentialing. Credentialing also allowed for more efficient evaluation of serum drug concentrations.

A NEW APPROACH TO STANDARDIZING NEONATAL CONTINUOUS INFUSIONS: MINIMIZATION OF INFUSION FLUID VOLUMES BY RATE AND WEIGHT CATEGORY. Boucher J, Lehigh Valley Hospital, P.O. Box 689, 1200 S. Cedar Crest Blvd, Allentown, PA 18105, United States; email: pjboucher@gmail.com

Introduction: A specialized system of standard concentrations for continuous infusions in the Neonatal Intensive Care Unit (NICU) was developed and implemented over approximately ten months. This is the first system we know of to include standardized concentrations for patients as small as 500 grams and to simultaneously minimize fluid volumes delivered via infusions. The resulting concentration grid was placed into CAPOE for electronic ordering. **Background:** The relatively wide range of patient weights in the NICU presents a unique

challenge to standardization of continuous infusions because extremely low and very low birth weight patients cannot tolerate excess fluid volumes. Additionally, it is desirable to use available fluid volumes for nutrition purposes as much as possible. Since both the ISMP and the Joint Commission have recommended standardization of continuous infusions in all pediatric patients, many hospitals are struggling to comply while observing these fluid restrictions in preterm neonates. Although some hospitals have published standardization approaches, the approach we describe, development of a tiered standard infusion system, is the first published system that we are aware of to describe infusions that consider both weight range and rate ranges in the standard concentration selection while aspiring to use the minimum infusion rate possible for patients as small as 500 grams. **Methods:** To develop the standard concentration system, a comprehensive review of available drug references and any published information regarding acceptable drug concentrations was performed. Medfusion syringe pumps are utilized in our NICU, allowing for accurate delivery of medication infusions at very low flow rates. Four factors were considered together to select the concentrations for each category: weights within each 500 gram range, infusion rate dose ranges, the maximum drug concentration possible, and pump flow limitations. The goal in selecting a concentration in each range was to maximize each weight and rate category to obtain a flow rate as close to 0.1 mL/hr as possible. **Discussion:** The resulting concentration grid complies with Joint Commission standards by standardizing and minimizing the available number of concentrations, while going a step further to simultaneously provide for minimization of fluid volume. The infusions are ordered electronically through CaPOE which improves safety of concentration selection. The system improves both infusion safety concerns and minimizes excess fluid volumes, allowing providers to maximize nutritional needs in these severely deficient patients. Additionally this is the first standardized concentration system we are aware of that provides individualized concentrations for patients under 2 kg.

A RETROSPECTIVE REVIEW OF TREATMENT FOR ALLERGIC BRONCHOPULMONARY ASPERGILLOSIS IN PATIENTS WITH CYSTIC FIBROSIS.

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Background: Children with cystic fibrosis (CF) are at an increased risk for multiple pulmonary infections, including Aspergillus fumigatus. The presence of aspergillus in CF patients leads to a constellation of clinical symptoms referred to as allergic bronchopulmonary aspergillosis (ABPA) and there is evidence to suggest that ABPA leads to a faster decline in lung function. The primary objective of this study was to evaluate the therapeutic outcomes associated with standard and novel treatment regimens used for management of CF related ABPA at The Children's Hospital. **Methods:** A retrospective chart review was conducted in patients who received a diagnosis of and/or were treated for CF related ABPA between 01/01/1997-10/31/2007 with an age range from 1 month-40 years. The primary end point was to evaluate the therapeutic efficacy of the employed ABPA treatment regimen using the following criteria: FEV1 (forced expiratory volume in one second), IgE, and changes in admission symptoms. A return to baseline was defined as a complete resolution of admission symptoms and a return to baseline FEV1 at discharge. We enrolled fifty CF patients (mean age 15.2 ± 6.2) either diagnosed with (n = 26) or treated for ABPA (n = 24). **Results:** The most commonly reported admission symptoms included worsening cough (80%), increased sputum production (42%), and shortness of breath (40%). On admission the mean FEV1 was 56% ± 19% and serum IgE was 808 IU/mL (range 3-5966). The standard treatment regimen was oral prednisone (n=23; mean dose = 0.433 mg/kg/dose, range 10-40mg; mean treatment length = 10.60 days, range 5-30) with 51% achieving a return to baseline. Novel treatment regimens included itraconazole (n = 42; mean dose = 2.71 mg/kg/dose; mean treatment length = 11.79 days, range 1-30) with 76% returning to baseline, voriconazole (n = 13; mean dose = 2.33 mg/kg/

dose; mean treatment length = 8.77 days, range 1-14 days) with 61% returning to baseline, nebulized amphotercin (n = 2; mean dose = 2 mg; mean treatment length = 5.5 days, range 4-7 days) with 50% returning to baseline, and azathioprine (n = 1; mean dose = 250 mg; mean treatment length = 5 days) which did not result in symptom improvement. Therapeutic outcomes associated with both of these treatment regimens led to a 28.5% improvement in mean FEV1 (72% ± 23%), and a 24% decrease of mean IgE (624 IU/mL, range 3-4208). As one of the leading CF centers in the nation, we are continuously seeking innovative ways to treat and improve the morbidity our patients. **Conclusion:** Our results indicate that novel therapies can lead to improved therapeutic outcomes, however, additional studies are warranted to further define the role of these novel therapies.

COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE) FOR PARENTERAL NUTRITION IN THE NEONATAL INTENSIVE CARE USING ABACUS SOFTWARE BY BAXA CORPORATION. Smith T, Simmons M, Carter C. Sacred Heart Hospital, 5151 N. Ninth Ave, Pensacola, FL 32504, United States; email: tsmith@shhpens.org

Introduction: Computerized Physician Order Entry (CPOE) is becoming more prevalent in efforts to prevent medication errors. We trained neonatal physicians/practitioners to order parenteral nutrition (TPN) with Baxa's Abacus TPN software to increase accuracy and improve TPN ordering efficiency. Initial discussions started in July 2007 and installation and training was completed by January 2008. **Background:** TPN ordering in the neonatal population can be very complex. Fluid concentrations and calcium/phosphate ratios are important issues in this patient population and must be evaluated closely for optimal dosing. CPOE would provide instant access to fluid concentrations and calcium/phosphate content in a TPN order. Although the Abacus program is set up for various levels of CPOE, there are few institutions that have implemented it for neonatal and pediatric practitioners. **Program Description/ Methods:** We discussed the TPN CPOE project with the physicians in July 2007. We do not use CPOE in the hospital, so this would be a new concept to the staff. It took several months to coordinate networking between the nursing unit and the pharmacy servers, and then route all the databases and printers appropriately. The Abacus software is user friendly and the practitioners learned it with relative ease. Training was completed by all the practitioners within 3 weeks. Abacus allows users to be set up with different levels of authority. We set up the practitioners with limitations to allow them to enter an order and view any dilutional errors, solubility problems, or dosing errors before sending the order to the pharmacy for completion. There are dosing alerts (minimum and maximum doses) on all individual items and calcium/phosphate precipitation curves to warn the practitioner to any possible problems that might occur with the requested recipe. The practitioner must justify anything that is outside the normal dosing range, but cannot exceed the absolute maximums set for any component of the TPN. Once the practitioner has completed the order, a paper copy is printed for the chart and signed as an official order. The pharmacist electronically approves the order and sends the information to the IV compounder for completion. **Discussion/Conclusion:** Abacus has multiple safeguards that allow practitioners to enter TPNs with alerts to potential problems before orders are sent to pharmacy for review. The satisfaction for TPN ordering had increased significantly with the practitioners and fewer calls are being made to change orders for volume and solubility issues. It is felt that implementation of the program has increased accuracy of TPN ordering and provided an extra level of error prevention for the patients.

DEVELOPMENT OF A COMPUTERIZED "PEDIATRIC SURGERY / ANESTHESIA MEDICATION DOSING CHART". Fiechtner H, Becker B, Anderson K, Gartner S, Lunn RJ. Sanford Children's Hospital, 4329 E 36th ST, Sioux Falls, SD 57103, United States; email: Helen.Fiechtner@usd.edu

Introduction: An Excel spreadsheet program was developed to print standardized medication dosing information for pediatric surgical patients. This multi-disciplinary project took

approximately 8–12 months to complete. **Background:** Fourteen anesthesiologists and 57 CRNAs handle the 20,800 surgeries performed yearly at SMC, with 15% being pediatric cases. Medication dose calculations for the pediatric surgical patients had not been standardized, although various computer programs were acquired from other hospitals and the internet in an attempt to do so. The decision was made to develop our own computer program based on our hospital formulary, to improve patient safety and to standardize practice throughout the pediatric surgical experience. **Program Description/Methods:** This computer program was developed utilizing the expertise of two CNRAs, one pediatric anesthesiologist, one OR pharmacist, one pediatric clinical pharmacist and the RN NICU computer programmer. After entering a patient's name and weight, a three page medication worksheet is generated for each pediatric patient at the time of their admission to the OR. The first two pages provide dosing information for medications grouped according to therapeutic category. Information included for each medication is the usual dose range per kg of body weight, and the calculated actual dose and dose volume for the highest and lowest dose within the range. Doses and volumes display in each drug's usual unit of measure, i.e., mg, mcg, grams, or mL. During the programming and checking process, several special features were added, including an age calculation which allows several medications to have different dosing parameters for the youngest patients. An asterisk appearing by a dose indicates the maximum dose was used. The standard concentration of each medication prints directly after its name. The use of color has made the sheets easy to read. The third page displays commonly used continuous infusion medications, their standard concentrations, and if the infusion is available as a pre-made solution, or the standard way the drip is to be prepared, i.e. mg or units per standard volume. The usual dosage range and an abbreviated drip rate table appear. Again, color is used to separate information for each medication. The computer program is housed on a central server allowing the program to be accessed and used on all specified computers in the surgery department. Upgrades can be done by changing the central file. **Conclusion:** This program has helped us meet our goal to have standardized medication dosing information available for all pediatric surgical patients. The layout of the spreadsheet and the use of color have made the information easy and visually pleasing to use. Most importantly, it has prevented calculation and measuring errors. The surgical staff feels this tool is extremely helpful, and vital to patient safety.

USING CONTEMPORARY LITERATURE IN A WOMEN & CHILDREN'S HEALTH PHARMACY ELECTIVE. Fiechtner H. South Dakota State University, Sanford Children's Hospital, 4329 E 36th ST, Sioux Falls, SD 57103, United States; email: Helen.Fiechtner@usd.edu

Introduction: *Women and Children's Health* is a 3rd year pharmacy (P3) elective which incorporates various learning methods and activities. Having required term papers for ten years, the instructor changed this assignment in 2006 to allow the students to choose one of three activities. One of the choices was to read the novel My Sister's Keeper by Jodi Picoult. The following year, an additional book selection, The Spirit Catches You and You Fall Down, A Hmong Child, Her American Doctors and the Collision of Two Cultures by Anne Fadiman was added. **Background & Program Description:** This elective course has been designed to introduce diverse topics about women and children's health not covered elsewhere in the curriculum, providing the student the opportunity to become a better, more well-rounded health care provider. This elective has always included various learning activities such as weekly journal writings, a safety poster presentation, an internet assignment on folic acid, and viewing a baby care DVD. After reading and discussing the book My Sister's Keeper with another colleague, the instructor felt the book illustrated many issues faced by families with a chronically ill child. Activities associated with this reading selection could replace the traditional term paper. The students were required to write two book reports, participate in a small group discussion, and lead a formal class presentation / discussion on the book. Due to the overwhelmingly positive response from

the first group of students who read My Sister's Keeper, the instructor added a second book choice in 2007. The Spirit Catches You and You Fall Down is a thought-provoking story about the encounter between a Hmong family and the American medical community. It is used by many universities in the study of cultural diversity. The clash of characters with completely different world views allows the pharmacy student to think about how to provide pharmaceutical care to patients with different medical traditions, cultures, and understanding of simple things such as the concept of time.
Conclusions: Course evaluations specific to the contemporary book assignments have shown exceptional approval. Students have liked the change in the type of learning activity from their other classes; they could actually read a non-pharmacy book yet learn ideas important to their future practice. They have enjoyed the required book discussions as well as informal outside-of-class discussions. The plan is to add a third book choice for the fall of 2008, as many students have already read the other selections and the enrolment for the class is increasing.

HIGH RISK AND LOW USE: STREAMLINING PEDIATRIC CHEMOTHERAPY.
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Introduction: A sudden increase in the submission of inaccurate pediatric chemotherapy regimens at a Children's Hospital, created an urgent need for modification of the existing procedures. A secured shared computer drive (S drive) was established to facilitate safe delivery of these high risk chemotherapeutic regimens in a pediatric population.
Background: In the months preceding this initiative, two Pediatric Advanced Practice Nurses (APN) in Hematology/Oncology left the institution. The Children's Hospital, which delivers inpatient chemotherapy to an average of five patients per week, found themselves in an urgent situation when attending physicians began handwriting chemotherapy orders. Chemotherapy orders were previously written by the APN, with an attending oncologist then verifying and signing the orders. Immediately following the APN departure, there were several written pediatric chemotherapy orders which contained dosing errors and errors of omission submitted to the pediatric pharmacy satellite.
Program Description/Methods: A multidisciplinary meeting convened, and uncovered many shortfalls in the chemotherapy ordering and administration process. The Children's Hospital is an Epic institution, with the implementation of Beacon (chemotherapy module) not expected for two years. The immediate goal is to eliminate the risk of harm to all pediatric patients receiving chemotherapy in the Children's Hospital. This goal is to be reached through the creation of the S drive which allows sequential physician, pharmacist, and nursing review and approval of chemotherapy orders electronically, prior to a patient's scheduled admission for chemotherapy.
Results: The S drive became functional in April of this year. With the implementation of the S drive, multi-disciplinary review of chemotherapy orders occurs approximately one week prior to a scheduled chemotherapy admission. Several monitoring tools have been implemented with the S drive including an inpatient chemotherapy worksheet to track a patient's orders, and a quality grid. The grid tracks clinical and operational improvements in the delivery of these high risk medications. Up to date Children's Oncology Group (COG) roadmaps are now included with every pediatric chemotherapy order which is presented to the pharmacy for review.
Discussion/Conclusion: Through the implementation of a shared computer drive, a high risk group of medications is now delivered to pediatric patients in a more timely and safe manner. In addition, with the initiation of this project, several other shortcomings were identified and procedures have been modified as well as quality measures and tools implemented. Multi-disciplinary meetings are ongoing on a weekly basis to refine the S drive and related procedures, and the adult population is discussing the use of this procedure to enhance chemotherapy delivery in this patient population.

OVERCOMING CPOE LIMITATIONS IN PRESCRIBING OF PEDIATRIC CONTINUOUS DRUG INFUSIONS. Wang H, Rossique-Gonzalez M, Pino R, McLaughlin G. Holz Children's Hospital, Jackson Health System, 1611 NW 12th Avenue East Tower 6003, Dept. Pediatric Pharmacy, Miami, FL 33136, United States; email: rpino@jhsmiami.org

Introduction: Computerized physician order entry (CPOE) has been shown to improve the medication ordering process and reduce medication errors in Pediatric patients. Commercially available CPOE systems may not provide adequate medication decision support processes for the prescribing of pediatric medications particularly intravenous drug infusions. **Background:** Pediatric patients present a unique medication prescribing challenge due to the large variability in age and weight, wide dosing ranges, disease states and fluid status requirements or limitations. These factors complicate the selection of an appropriate intravenous infusion concentration. In an effort to facilitate the intravenous infusion ordering process and overcome the limitations of our CPOE system, we have designed the CPOE screens to provide dosing decision support at the initial point of order entry. **Program Description:** Creation of standardized drug infusion concentrations was accomplished to meet JCAHO's mandate and to accommodate the wide and variable needs of our pediatric population. IV Care sets listing all concentrations for each continuous intravenous medication were created with the suffix (PEDS) for ease of identification. Components of the IV Care set include: the drug amount in a solution volume; the concentration per ml volume; Weight Based and Dosing Decision Support guidelines; IV Rate Reference and Order Details which provide recommended dose ranges. The physician selects the desired medication IV Care set and all available solution concentrations appear on the subsequent screen. The standard concentration appropriate for most patients is listed first with all other concentrations in descending order. Decision Support guidelines based on patient's weight and dose range and an Initial Dose IV rate reference are included under each concentration to guide the physician in the selection of an appropriate infusion concentration to meet their patient's needs. An important selection criteria is the hourly intravenous rate which is easily calculated by multiplying the patient's weight by the Initial Dose IV rate reference. This is extrapolated to also determine the IV rate for a higher or different dose required, since our CPOE system does not support calculations of IV rates at the time of ordering. **Discussion:** CPOE and point of care Decision Support can reduce provider error in ordering of medications and intravenous infusions and improve patient safety. Implementation of CPOE and Dosing Decision Support guidelines for our pediatric drug infusions is scheduled for completion by end of calendar year 2008.

PALIVIZUMAB SCREENING BY A PHARMACIST IN THE NEONATAL INTENSIVE CARE UNIT. Dawson K, Bethany Lynch. MCG Health, 2515 Center West Pkwy 4-O, Augusta, GA 30909, United States; email: dawson.207@osu.edu

Introduction: A pharmacist screening of every patient in the NICU to determine eligibility to receive a dose of palivizumab prior to discharge from the hospital was implemented in October 2007. **Background:** Palivizumab is an immunization for the prevention of serious respiratory disease caused by respiratory syncytial virus (RSV) in high risk infants. In 1998, the American Academy of Pediatrics (AAP) developed specific guidelines for palivizumab which included that every infant that qualifies should receive one dose prior to discharge. In 2006, MCG conducted a retrospective medication use evaluation that showed that many NICU patients did not receive a dose of palivizumab prior to discharge when indicated. **Program Description/Methods:** The development of the program began with discussion between neonatologists, nursing staff and pharmacists in September 2007 about the need for a program to determine patient eligibility for palivizumab. The pharmacists then developed a one-page assessment sheet to determine patients' eligibility to receive palivizumab according to the AAP guidelines. Multiple educational inservices were performed by the

pharmacists to the NICU staff encompassing RSV, the new program and the need to educate caregivers about RSV and palivizumab. Starting at the beginning of RSV season in 2007, a pharmacist preformed a once weekly assessment of every admission to the NICU. Once the assessment was performed, a red or green sticker with the letters RSV was placed on the patients name card at the bedside. A red sticker indicated that the patient did not qualify verses a green sticker indicated that the patient did qualify. A review of the new program, from October–December 2007 versus October–December 2006, before the program, was compared to determine if there was a difference in the percentage of patients who received palivizumab when indicated after the pharmacist assessment was implemented. **Discussion and Conclusion**: The data showed that the pharmacist assessment increased the percentage of patients who actually received the drug prior to discharge when indicated from 65% (24/37) to 94% (30/32). Thirteen patients in 2006, verses only two patients in 2007 did not receive palivizumab after the pharmacist-driven screening was implemented. The two patients that did not receive palivizumab in 2007 were both cardiac patients and were no longer under the care of the NICU when discharged. Because of the clinically significant difference that was made with the pharmacist assessment, it is the intention of MCG to continue this program as a year-round service.

PHARMACY DRIVEN "VANILLA" STARTER SOLUTION PROGRAM TO DECREASE TIME TO INITIATION OF PARENTERAL NUTRITION IN VERY LOW BIRTH WEIGHT INFANTS. Kelly B, Engelhardt E. Washington State University, Yakima Valley Memorial Hospital Pharmacy Department, 2811 Tieton Drive, Yakima, WA 98902, United States; email: bdkelly@wsu.edu

Introduction: Yakima Valley Memorial Hospital is a non-profit community hospital and major birth center in Central Washington. The 18 bed neonatal intensive care unit (NICU) cares for approximately 300 babies annually, about 10% considered very low birth weight (VLBW) infants (birth weight <1500 grams). The "vanilla" parenteral nutrition (PN) protocol, developed in May and implemented June 1, 2007, provides a pre-made non-patient-specific dextrose and amino acid solution for VLBW newborns. **Background:** Early aggressive nutrition is imperative in the management of the VLBW infant. Studies show that amino acid administration directly after birth is safe and limits catabolism, preserving endogenous protein stores. It improves nitrogen balance and glucose tolerance and decreases the incidence of growth failure. The Vermont Oxford (VO) Network "Food for Thought" initiative includes an aim to initiate PN as soon as possible after delivery in VLBW infants. The VO committee at Memorial set a goal in 2005 to substantially reduce time to PN in VLBW infants and for PN to be the first IV fluids after birth. **Program Description/Methods:** Neonatal health care providers came to consensus on program details in May 2007 and pharmacy implemented the "vanilla" PN program June 1, 2007. Two 250 mL bags with 10% dextrose, 2% amino acids (AminosynPF) and 1 unit/mL heparin are stored in the central pharmacy (14 day expiration refrigerated). After notification from the NICU of an anticipated VLBW infant, a "vanilla" PN is sent to the delivery room for administration as soon as IV access is obtained. The infant is converted to a patient specific PN within 24 hours. **Discussion and Conclusion**: Retrospective chart review was done on VLBW infants from February 2006 to May 2007 and the mean time to PN initiation was 14.5 hours (2.3-25.4 hours) in the 24 infants with available data. Since June 2007, all VLBW infants have received "vanilla" PN. The average time to PN was 1.62 hours (0.95-3.4 hours) or 97.2 minutes (57-205 minutes). This is an 89% reduction (n = 24 from June 2007–May 2008). The rate limiting factor is time to establish IV access, not distribution from pharmacy. Data will be presented on cost, time to return to birth weight, duration of PN therapy, and length of stay before and after the "vanilla" PN protocol. Use of a premade "vanilla" PN solution substantially reduced time to PN initiation in VLBW infants in a community hospital and is the first IV fluids administered after birth.

SYSTEMATIC REVIEW OF MEDICATION ERRORS IN PEDIATRIC PATIENTS. Sen D, Gohil K. SSPC, Darwaja Street, Tarapur, Gujarat 388180, India; email: gohilankit_pharma@yahoo.co.in

Objective: To systematically locate and review studies that have investigated the incidence of medication errors (MEs) in pediatric inpatients and identify common errors. **Methods:** A systematic search of studies related to MEs in children was performed using the following databases: MEDLINE (1951-April 2006), EMBASE (1966-April 2006), Pharm-line (1978-April 2006), International Pharmaceutical Abstracts (1970-April 2006), Cumulative Index to Nursing and Allied Health Literature (1982-April 2006), and British Nursing Index (1994-April 2006). Studies of the incidence and nature of MEs in pediatrics were included. The title, abstract, or full article was reviewed for relevance; any study not related to MEs in children was excluded. **Results:** Three methods were used to detect MEs in the studies reviewed: spontaneous reporting (n = 10), medication order or chart review (n = 14), or observation (n = 8). There was great variation in the definitions of ME used and the error rates reported. The most common type of ME was dosing error, often involving 10 times the actual dose required. Antibiotics and sedatives were the most common classes of drugs associated with MEs; these are probably among the most common drugs prescribed. **Conclusions:** Interpretation of the literature was hindered by variation in definitions employed by different researchers, varying research methods and setting, and a lack of theory-based research. Overall, it would appear that our initial concern about MEs in pediatrics has been validated; however, we do not know the actual size of the problem. Further work to determine the incidence and causes of MEs in pediatrics is urgently needed, as well as evaluation of the best interventions to reduce them.

UTILIZING PHARMACY RESOURCES TO PROVIDE PATIENT EDUCATION AND THE EFFECT ON CAREGIVER SATISFACTION. Patel S, Weintraub N, Weld M. Children's Specialized Hospital, 293 Pinelli Dr, Piscataway, NJ 8854, United States; email: spatel@childrens-specialized.org

Introduction: Pharmacists can contribute to positive outcomes by educating and counseling patients and their caregivers. At Children's Specialized Hospital (CSH), patient education and counseling is an important part of overall care. The objective of this study was to quantify Pharmacy resources required to provide patient education and counseling upon discharge and to measure patients' caregivers' satisfaction with the pharmacy service. **Methods/Design:** Beginning December 2007, pharmacists' role in providing patient education and counseling was evaluated at CSH, a pediatric rehabilitation hospital. Pharmacists were requested to document the time required preparing for the counseling session, the number of medications counseled per patient, and the time required for completing the counseling session. Pharmacist were allowed to utilize various educational tools such as patient education leaflets, medication administration chart, oral syringes and pill cutters for demonstration, and an interpreter if needed during the counseling session. At the end of a counseling session, the patient caregiver was asked to repeat medication instructions provided and demonstrate the correct amount of medication to be administered. A questionnaire was used to measure caregiver's understanding of instructions provided by the pharmacist and the overall satisfaction with the counseling session. **Results:** Since December 2007, thirty-one patients had received pharmacist counseling service upon discharge. The average number of medications discussed during a counseling session was nine. The average time required to prepare and complete a counseling session per patient was 40 minutes and 53 minutes, respectively. The preliminary result of overall satisfaction with the pharmacists' counseling service is 90.3% thus far but research is in progress. Surveys continue to be collected and final results are pending. **Conclusions:** At CSH, pharmacists' involve-

ment in providing patient counseling has helped the patient's caregiver to better understand the information related to the patient's drug therapy. The findings of this study may help other institutions better estimate the pharmacist's overall time required for providing patient counseling services.

MEDICATION ADMINISTRATION CHART ENHANCING CAREGIVER'S UNDERSTANDING OF COMPLEX DRUG REGIMEN. Patel S, Mehta S, Weintraub N, Weld M. Children's Specialized Hospital, 293 Pinelli Dr, Piscataway, NJ 8854, United States; email: spatel@childrens-specialized.org

Introduction: At Children's Specialized Hospital, a colorful medication administration chart is created for patient caregivers to help them overcome some of the challenges that exist during patient counseling sessions. This tool allows pharmacists to effectively educate patient's caregivers regarding complex medication administration instruction. This tool is used to create a visual reminder for caregivers administering medications at different time. **Background:** Children's Specialized Hospital is a pediatric rehabilitation hospital which provides inpatient specialty health as well as developmental and rehabilitation services to infants, children, adolescents, and young adults. Diagnosis of these patients may include spinal chord injury, traumatic brain injury, and/or genetic deficiencies requiring multiple medications as part of the treatment. For a patient caregiver, some challenges are to understand the patient's drug regimen, follow dosing instructions related to multiple medications, and to determine the amount of medication to be administered. For pharmacists, the challenge is to ensure that the patient caregiver have an understanding of all directions related to medication administration. To address these challenges, a colorful medication administration chart was created to easily identify medications, the time of administration, and the dosage. **Methods:** Microsoft Excel program was used to create a template of the medication administration chart for the pharmacy department. The chart is organized into two sections, day time and night time. The chart includes one hour dosing intervals in each section. Depending on the time of administration, patient's medications are listed in each section with appropriate dosing instructions. A different color is used for each medication within the chart. Appropriate cells under the dosing interval are filled with the same color corresponding to the medication and its dosing frequency. In addition, the amount of medication (e.g. 3 mL, 1 ½ tablets, etc.) to be given is noted in the highlighted cell. The completed chart is provided to the patient caregiver during the counseling session. **Conclusion:** Patients' caregivers' have found this tool very helpful in visualizing and comprehending medication instructions. The color coded chart helps the caregiver identify the right medication to be given at the right time. This tool may help increase safe administration of medications to infants and children.