CSHP Professional Practice Conference 2010 : Poster Abstracts/ Conférence sur la pratique professionnelle 2010 de la SCHP : Résumés des affiches

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Le Journal canadien de la pharmacie hospitalière *n'a pas soumis le texte des résumés des affiches à une révision linguistique et les publie ici tels que remis par les auteurs.*

Incidence of, and Risk Factors for, Upper Gastrointestinal Bleeding in Critically Ill Children: A Systematic Review

Robin Brockhouse-Gunning, Mark Duffett
Hamilton Health Sciences, Hamilton, ON

Rationale: Critically ill children can develop upper gastrointestinal bleeding (UGIB), which can be associated with clinically important complications. The effectiveness of prophylaxis for UGIB in children is unknown. In the absence of randomized trials, information on the incidence and risk factors for UGIB may help target prophylactic interventions to those children at highest risk.
Objectives: To determine the incidence of, and risk factors for, clinically significant UGIB in critically ill children.
Methods: We searched MEDLINE and EMBASE, and hand-searched references lists of relevant articles. Cohort or case-control studies were included if they enrolled children (full-term infants to 18 years) in a pediatric intensive care unit (PICU) and reported some measure of incidence or multivariate analysis of risk factors for UGIB. We assessed the methodological quality of all included studies.
Results: The search retrieved 425 citations. Of these, 5 citations (enrolling a total of 2478 subjects) were included. We did not pool the results because of heterogeneity in the severity of illness and use of prophylaxis; patient characteristics; definitions of bleeding; and differences in research methods. Based on a single study (1006 admissions) the incidence of clinically significant UGIB was 1.6%. The incidence of all UGIB ranged from 6.4% to 24.5% (3 studies, 2198 admissions). Risk factors for clinically significant UGIB were evaluated in 1 study and included coagulopathy, respiratory failure, and PRISM score ≥ 10. These are also risk factors for all UGIB. Additional risk factors for all UGIB include shock, trauma, operative procedures of at least 3 hours, and pneumonia. Enteral nutrition may be a protective factor against UGIB.
Conclusion: Information on clinically significant UGIB in children is limited. Incidence and risk factors vary based on the population studied and bleeding endpoints used. Future studies should use clinically significant UGIB as an outcome.

The Gap between Evidence Based Medicine, Federal Drug Regulations and Clinical Practice: A British Columbia Health Authority's Approach

Doson Chua, St. Paul's Hospital, Vancouver, BC
Angela Lo, Providence Health Care – Vancouver Coastal Health Authority, Vancouver, BC

Vancouver Coastal Health Authority (VCHA) implemented a therapeutic interchange policy (TIP) for all angiotensin converting enzyme inhibitors (ACEI) to be substituted to the formulary ACEI, trandolapril. However, certain ACEI doses equate to a trandoloparil dose greater than the Health Canada recommended maximum of 4 mg daily. This lead to a situation where the approved TIP would substitute a non-formulary ACEI to a trandolopril dose that exceeds Health Canada's recognized trandolopril dosing. To resolve this dilemma, VCHA systematically reviewed the evidence behind the approved TIP conversion and publications on a safe and efficacious maximum dose of trandolopril, and requested information from the Canadian and US trandolopril manufacturers. The approved ACEI TIP conversion is based comparisons between several landmark trials and thus supported by strong evidence. There is no published data for trandolopril doses greater than 4mg daily, but the US trandolopril monograph refers to unpublished, company data supporting doses of 8mg daily. The US Food and Drug Agency also supports a maximum of 8 mg daily for trandolapril. It therefore appears that the trandolopril maximum dose discrepancy is a result of regulatory differences only. VCHA adopted a maximum dose of trandolopril 8mg for its ACEI TIP based on the US trandolopril monograph and the strength of evidence behind the approved TIP. The VCHA approach to this therapeutic dilemma helped bridge the gap between evidence based medicine, federal drug regulations, and clinical practice. This approach can be applied to other therapeutic dilemmas that are encountered, particularly with pharmacotherapeutic interchange policies.

Antimicrobial Stewardship at Sunnybrook Health Sciences Centre: Prospective Audit and Feedback in Critical Care

Marion Elligsen[1], Sandra Walker[1,2], Nick Daneman[3,4], Andrew Simor[3,4]
[1]Sunnybrook Health Sciences Centre, Department of Pharmacy
[2]University of Toronto, Faculty of Pharmacy
[3]Sunnybrook Health Sciences Centre, Division of Infectious Diseases
[4]University of Toronto, Department of Medicine, Toronto, ON

Rationale: Recently, there has been increased pressure to institute formal antimicrobial stewardship programs in Ontario hospitals to limit unnecessary use of antimicrobials, decrease resistance, decrease antimicrobial complications and reduce costs. Prospective audit and feedback has been recommended by professional associations and has been successfully implemented in some institutions because it is recognized as an effective method of introducing antimicrobial stewardship.
Description of Service: The initial target of the prospective audit and feedback program, at our institution, are the critical care units (CRCU, CVICU, RTBC), since they have the highest rate of antimicrobial resistance and antimicrobial use. All patients admitted to one of these units will be reviewed if they have received one of the following antibiotics for at least 2 days: pipercillin-tazobactam, meropenem, ertapenem, imipenem, ciprofloxacin, levofloxacin, moxifloxacin, ceftazidime, ceftriaxone and vancomycin. The antimicrobial stewardship fellow will review the cultures, labs and bedside chart and relevant data will be entered into a database. Each patient will be reviewed with the ID pharmacist and suggestions will be made based on previously agreed upon criteria for appropriate use of targeted antimicrobials. All suggestions will be reviewed by an ID physician, and if the suggestions are approved, then they will be communicated to the critical care staff via progress notes and daily discussion.
Evaluation of the Project: Plans to evaluate the acceptance of the program (number of accepted suggestions, distribution of suggestion type, reasons for suggestion rejection, and patient outcome) will be evaluated on a monthly basis. Antibiotic utilization and cost savings will also be evaluated after 6 months. Resistance rates, incidence of C.difficile, average length of stay and mortality will also be compared pre and post intervention.
Usefulness to Current Practice: Currently there is no formal antimicrobial stewardship program at Sunnybrook Health Sciences Centre and it is anticipated that the institution of a prospective audit and feedback program may limit the unnecessary use of antimicrobials and therefore decrease resistance, antimicrobial complications and antimicrobial expenditures. We hope to have some specific data to share regarding this incentive by the Professional Practice Conference held in February 2010.

Determination of Initial Vancomycin Dosing Recommendations in Burn Patients—Retrospective Chart Review

Marion Elligsen[1], Sandra A.N. Walker[1,2], Scott E.Walker[1,2], Andrew Simor[3,4]
[1]Sunnybrook Health Sciences Centre, Department of Pharmacy
[2]University of Toronto, Faculty of Pharmacy
[3]Sunnybrook Health Sciences Centre, Division of Infectious Diseases
[4]University of Toronto, Department of Medicine, Toronto, ON

Rationale: Vancomycin pharmacokinetics are altered in burn patients resulting in higher dosage requirements to achieve target trough concentrations. Currently, there are no published empiric dosing recommendations to target troughs of 15-20mg/L for this population.
Objective: This study was conducted to determine vancomycin pharmacokinetics in burn patients and develop practical initial dosing recommendations.
Methods: A retrospective chart review of 50 burn patients who received vancomycin was conducted. Pharmacokinetic parameters were calculated using first order equations.
Results: A CART analysis revealed that clearance was highest in the first 14 days post burn. All pharmacokinetic parameters were significantly ($p<0.05$) different for vancomycin levels obtained from 48h to 14 days post-burn versus > 14 days post-burn. The geometric mean (95% CI) pharmacokinetic parameters in patients receiving vancomycin within 14 days post burn were: $t_{1/2}$ 6.18 (5.64-6.77) hr; *Vd* 0.86 (0.79-0.95) L/kg and *Cl* 7.88 (6.95-8.93) L/hr. For patients receiving vancomycin after 14 days post burn: $t_{1/2}$ 7.12 (6.57-7.71) hr; *Vd* 0.70 (0.65-0.75) L/kg and *Cl* 5.66 (5.24-6.13) L/hr. Using Monte Carlo simulation the most commonly used empiric dosing regimen (1g q12h) would only attain target troughs with a probability of <10%. The probability of attaining target troughs was optimized to 20-25% by using 1-1.25g q6h in patients 48h - 14 days post burn and 1-1.25g q8h in patients > 14 days post burn.
Conclusions: This study has made recommendations for initial vancomycin dosing in burn patients. However, the maximum probability of attaining troughs between 15–20mg/L with these dosing recommendations is only 20–25%. Therefore, monitoring of vancomycin serum concentrations is required to ensure targets are achieved. In addition, the pharmacokinetics will change with respect to time post-burn necessitating continued periodic monitoring of serum concentrations and subsequent dosage adjustment.

Bisphosphonates in Osteoporosis: An Analysis Focusing on Drug Claims by Seniors 2000 to 2007

M. Gaucher, J. Hunt
Canadian Institute for Health Information, Ottawa, ON

Rationale: Bisphosphonates are effective in reducing the risk of fractures and are used to prevent and treat osteoporosis. Between 2000 and 2007, new bisphosphonate chemicals and dosage formulations were introduced into Canada, and new evidence and practice guidelines emerged.
Objective: This analysis identified trends in the use of three bisphosphonates used for osteoporosis in seniors on public drug programs in six Canadian provinces between 2001-2002 and 2006-2007.
Study Design and Methods: Claims level data from the National Prescription Drug Utilization Information System (NPDUIS) Database were analyzed for seniors on public drug programs in Alberta, Saskatchewan, Manitoba, New Brunswick, Nova Scotia and Prince Edward Island. The analysis examined trends in the use of bisphosphonates among seniors, including trends in the use of daily and weekly therapy. It also examined a surrogate measure for compliance with therapy.
Results: The age–sex standardized rate of bisphosphonate use across all provinces increased from 8.9% in 2001–2002, to 12.9% in 2006–2007. The rate of use among females (20.4%) was more than six times the rate of use among males (3.3%). The rate of use of weekly therapy increased from 0.1% to 8.4%, while use of daily therapy dropped from 9.3% to 5.3%. Measures of compliance showed similar results for patients on daily and weekly therapy.
Conclusion: This analysis provides insight into how the introduction of new chemicals and dosage formulations affected bisphosphonate use among seniors. There was a significant shift to the use of newer therapies as well as from daily to weekly therapy. There was little difference in compliance between daily and weekly users.

Teaching Residents to Teach: Development of a Teaching Rotation for a Pharmacy Practice Residency

Henry Halapy, Tom Chin, Sharan Lail, Cheryl Reid, Lucy Chen, Ann Leung, Janice Wells
St. Michael's Hospital, Toronto, ON

Rationale: Pharmacists are increasingly called upon to teach students as part of their daily clinical activities. In fact, academic teaching is one of the objectives of CHPRB accredited residency programs. However, residency training has often overlooked this important skill. Our program attempted to address this apparent training deficiency by developing and implementing a resident teaching rotation.
Description/ Implementation: A longitudinal and multi-faceted teaching rotation was designed and implemented in 2006 containing a series of activities for the resident to complete over the residency year. The first activity involved resident-led discussion around adult education theory. Topics included setting learning objectives, learning and teaching styles (including self-directed learning), principles of feedback, and techniques about one-to-one and small group learning. The second activity involved giving a didactic session to pharmacy technicians, and included setting learning objectives, developing the content and delivering the session. The third activity consisted of leading a group of undergraduate pharmacy students in two interactive mini case discussions. The resident was responsible for picking the topic and patient case, setting learning objectives, selecting and providing the students with appropriate articles, leading the students through the case discussion using small group learning techniques while maximizing student participation.
Evaluation: Three residents have completed the teaching rotation. Feedback about the rotation was solicited through residency evaluation forms. Residents said this rotation was a valuable learning experience, helped them gain teaching experience, and increased confidence to teach pharmacy students in the future. Student evaluations of the resident-led case discussions indicated a positive learning experience. Students rated the resident through a five point scale (1 to 5, 5 being the highest score), giving mostly 4's and 5's to score the learning experience.
Conclusion: The resident teaching rotation has been a valuable addition to the residency curriculum and to the resident's learning experience.

Analysis of Medication Incidents in Ontario

Roger Cheng, Certina Ho, Carol Lee, Sibylle von Guttenberg, Lindsay Yoo
Institute for Safe Medication Practices Canada, Toronto, ON

Rationale: The Ontario Medication Incident Database (OMID) developed by the Institute for Safe Medication Practices Canada (ISMP Canada) has been capturing medication incidents since 2000. Analysis of the OMID can help identify high-risk areas in the medication-use process.
Description and Steps Taken: As of April 2008, 30,612 medication incidents have been voluntarily reported by 58 Ontario institutions and facilities and by individual practitioners. A quantitative analysis was performed with a focus on the severity of outcome of the incidents and medication-use areas associated with these incidents.
Evaluation: Most (90.10%) of the voluntarily reported medication incidents were associated with no harm, but 1,169 incidents (3.81%) were associated with a harm or death outcome. The three most common types of medication incidents resulting in harm or death were dose omission (27.89%), incorrect dose (27.20%), and incorrect drug (13.77%). The top 10 individual medications reported as causing harm or death through medication incidents were insulin, morphine, hydromorphone, heparin, fentanyl, warfarin, furosemide, potassium, metoprolol, and oxycodone. Drugs from floor stock (15.14%), intravenous solutions (13.26%), and infusion devices (8.98%) accounted for a significant proportion of the medication incidents reported as causing harm or death. The most common causes were miscommunication of drug order (9.92%), staff education problems (7.78%), environmental, staffing, or workflow problems (7.19%), and lack of quality control or independent check systems (6.16%).
Conclusion: It is impossible to infer the probability of specific incidents on the basis of the voluntary reports, but the OMID analysis suggests that there is a potential to significantly reduce preventable patient harm by focusing on several or specific high-risk medication-use areas.
Importance: As the OMID continues to accumulate data over time, trends and changes in medication incident patterns will be identified. OMID will continue to provide guidance to Ontario, and help identify new areas of focus to enhance medication safety.

Pharmaceutical Care Urgency Framework: Development of a Teaching Tool

Lawrence Jackson[1], Diane Vella[2], Dean Yang[1]
[1]Department of Pharmacy, Veterans Centre, Sunnybrook Health Sciences Centre, Toronto
[2]Pharmacy student, Leslie Dan Faculty of Pharmacy, University of Toronto

Rationale: Drug therapy problem (DTP) identification and prioritization are key functions of the pharmaceutical care practitioner and must be acquired by Pharmacy students. Guidance is available for prioritization of multiple DTPs, but is lacking with respect to the timeliness for addressing individual DTPs. An urgency framework, similar to triage was considered a useful tool to address this gap.
Description of the Project: Focus groups of Pharmacy students and experienced pharmacists were conducted separately to test the reasonableness of a proposed framework for categorizing the urgency with which clinical situations should be addressed.
Method: An urgency categorization scheme for DTPs that assigns a timeframe to the pharmacist's or other clinician's actions, which is akin to triage, was proposed. The categories of urgency include critical, high, medium and low, and each has a corresponding timeframe. The concept of importance was used to describe the patient's perspective and includes aspects such as risk for harm and motivating factors such as the usefulness of available treatments, and the patient's values and preferences. The authors created 43 examples of clinical conditions corresponding to the various levels of urgency and sought to corroborate these assumptions in the focus groups.
Evaluation: Focus group participants were asked to rate the urgency and timeframe for action for each clinical example. Pharmacy students agreed less often with the predetermined urgency categorization of the examples (R^2=0.61) compared to pharmacists (R^2=0.807). A similar difference was found for timeframe and was attributed to inexperience. The 4-level urgency framework with corresponding timeframes and degree of importance concepts were unanimously endorsed by Pharmacy students and pharmacists.
Importance to Practice: Pharmacy students perceived that the framework would be useful to them in their undergraduate education and pharmacists perceived that the framework would be useful for instruction of students during clinical rotations.

Monitoring and Documentation of Outcomes from Targeted Medication Interventions: Implementation using the Electronic Documentation System

Lawrence Jackson[1], Diane Vella[2], Kate Dewhurst[3], Dean Yang[1], Debbie King-Totty[3], Valerie Madill[3], Ean Sagadraca[3], Ria Spee[3], Maria Chang[4], Evelyn Williams[4]
[1]Departments of Pharmacy, [2]Pharmacy student, Leslie Dan Faculty of Pharmacy, UofT, [3]Nursing and [4]Medicine, Veterans Centre, Sunnybrook Health Sciences Centre, Toronto, ON

Rationale: We have shown that a monitoring resource guide and a paper-based communication system are effective strategies for increasing the frequency of documentation by nurses of outcomes from targeted medication interventions. However, the number of communications declined over time. The purpose of this project was to evaluate the impact of an electronic documentation system for communicating changes in pharmacotherapy among nurses and identify any challenges to implementing this process change.
Description of the Project: Intensive one-to-one education and the monitoring resource guide were provided to nurses of nursing home-level unit. A pre and post audit of nursing documentation was used to evaluate the impact of this process change and a survey was used to capture satisfaction among nurses.
What was Done: A clinical nurse educator and pharmacy student instructed nurses individually to ensure their familiarity with roles and responsibilities, and skill in using the electronic documentation system. Each medication alert entered in the computer appeared on a "To do list" to guide nursing actions. A pharmacy summer student conducted an audit of nursing notes one month pre and post implementation to determine the quantity and quality of documentation, and administered a satisfaction survey.
Evaluation: Documentation increased from 42% to 64% after one month. Although only 9/22 (40%) interventions were entered electronically, 8/9 of these entries resulted in documentation, indicating the value of the "To do list" as a communication tool. There was a high degree of satisfaction with the process change among nurses, and in terms of improving team interactions, awareness of the patient's progress and medication side effects. Individual engagement of nurses by a clinical nurse educator, and the monitoring guide were considered success factors.
Importance to Practice: This information/skill transfer initiative has improved team functioning and resulted in more information being available to support decisions related to pharmacotherapy.

Encore Presentation

Description of Drug Therapy Problems and Anticoagulation Outcomes in a Multidisciplinary Anticoagulation Clinic

Nicole Parker, Natalie Crown, Charlie Bayliff, George Dresser, Alejandro, Lazo-Langner, Richard Kim
London Health Sciences Centre, University Hospital, London, ON

Rationale: A new multidisciplinary anticoagulation clinic has become operational within our institution. The purpose of this study was to evaluate clinic services and to assess impact on non-anticoagulation related drug therapy problems (DTPs) in an under-serviced patient population.
Objectives: Objectives were 3-fold: to describe the types of DTPs identified and resolved in patients without a family physician; to assess quality of anticoagulation control; and to evaluate patient satisfaction.
Methods: A retrospective chart review was conducted to describe the types of DTPs documented, detected and resolved in patients without family physicians. Adequacy of anticoagulation control was assessed by calculating percentage time in range (PTIR) using the Rosendaal linear interpolation method in all patients followed for at least 3 months. PTIR was reported as target INR ± 0.5 units, and expanded PTIR as target INR ± 0.7 units. To evaluate patient satisfaction, a survey was developed and mailed to patients who had been actively followed for at least 3 months. Patients ranked agreement with 10 statements on a 5-point Likert scale.
Results: As of May 2009, 99 patients were actively followed or had been followed for at least 3 months. Of the total patients seen in clinic, 17% (n=22) did not have a family physician. 36 DTPs were detected and 86% were resolved. The most common DTPs identified were "unnecessary drug therapy" and "dosage too low". The mean PTIR was 63% and the mean expanded PTIR was 80%. Overall, 68% (41/60) patients responded to the satisfaction survey, and 100% were satisfied with the care provided by the clinic.
Conclusions: A number of DTPs were detected in patients without a family MD and a high proportion were resolved. The observed PTIR is consistent with the values reported in the literature and patients are highly satisfied with the care received.

Ziprasidone and Analgesic-Induced Serotonin Syndrome

Jessica Stovel, Joel Lamoure, Jennifer Barr, London Health Sciences Centre, London, Ontario
Jatinder Takhar, University of Western Ontario, London, Ontario

Rationale: Serotonin syndrome diagnosis involves a triad of changes: cognitive, neuromuscular, and autonomic. These symptoms will often start to develop within 2 hours of increasing the synaptic level of serotonin, usually resulting from polypharmacy. Serotonin syndrome necessitates early identification as death may result within hours in severe cases.
Description: A 10-year old boy weighing 44 kg presented to hospital with an arm fracture. The patient's medical history includes obsessive-compulsive disorder, Tourette Syndrome, and ADHD. Home medications include fluvoxamine, divalproex and methylphenidate. Ziprasidone was started in the past 48 hours. Intra-operatively, the patient received fentanyl, propofol, and morphine. Post-operatively, the patient received codeine and morphine. Post-operatively in hospital, the patient experienced two syncopal events with autonomic abnormalities (BP 146/97, HR 126), as well as elevated creatine kinase (417 U/L). Over the next 48 hours neuromuscular changes (tremor and blepharospasm), cognitive changes (confusion, short-term amnesia), and further autonomic changes (diaphoresis, flushing) occurred. Ziprasidone and opioid analgesics were discontinued within 24 hours of the syncopal episodes, however the patient was inadvertently re-challenged with olanzapine. This resulted in severe agitation requiring restraints.
Assessment of Causality: A temporal relationship between symptom onset and medications suggests highly probable serotonin syndrome. Over 24 hours, the patient demonstrated marked cognitive, autonomic, and neuromuscular improvements with discontinuation of ziprasidone and opiates. The Naranjo Probability Scale yields a score of 10, suggesting a highly probable adverse drug event.
Evaluation of the Literature: There is only one previous case report involving the addition of ziprasidone to a stable regimen of citalopram resulting in serotonin syndrome. There have been two published pediatric cases documenting post-operative serotonin syndrome in patients stable on serotonergic agents.
Importance to Pharmacy Practitioners: Proactive identification and awareness of cognitive, neuromuscular, and autonomic changes linked to polypharmacy can decrease serotonin-associated morbidity and mortality.

Fluconazole Treatment Failure in Cryptococcal Meningitis

Bonnie Thieu, Edward Ralph, Zafar Hussain, Anne Marie Bombassaro
London Health Sciences Centre, London, ON

Rationale: Cryptococcal meningitis (CM) is a life-threatening opportunistic infection that occurs predominantly in AIDS patients. Fluconazole is the treatment of choice for maintenance therapy. A case of recurrent CM despite high dose fluconazole administration is reported.
Description of Case: A 44-year-old AIDS patient presented with increasing headaches over 5 days, accompanied by severe neck pain, photophobia, phonophobia and general malaise. The medical history was significant for CM diagnosed 7 months earlier. On examination the patient was suspected of having recurrent CM despite receiving fluconazole 600mg/day for the past 7 months. Potential reasons for fluconazole treatment failure, including compliance, interactions, absorption, resistance, and immune reconstitution syndrome, were investigated. Culture positivity of the cerebrospinal fluid for *Cryptococcus neoformans* excluded the latter phenomenon. Intravenous amphotericin B and oral flucytosine were initiated.
Assessment of Causality: Increases in MIC between the initial and current episodes were observed for the following antifungals, with the exception of amphotericin B (1mg/L):
fluconazole 1mg/L and 64mg/L
itraconazole 0.06mg/L and 0.12mg/L
voriconazole ≤0.03mg/L and 0.25mg/L.
Evaluation of Literature: High-level resistance to fluconazole, among isolates of *Cryptococcus neoformans* in North America, is uncommon (1% at ≥64mg/L). A correlation between MICs ≥16mg/L and fluconazole treatment failure has been suggested in case series involving predominantly AIDS patients with CM. Only a limited number of reports documenting sequential increases in MIC and treatment failure in individual patients, similar to this case, have been published.
Importance of Case to Pharmacy Practitioners: While susceptibility testing is not recommended for routine care of patients with CM, it may be beneficial in cases of relapse or refractory disease, particularly when obvious reasons for treatment failure such as compliance, interactions, and malabsorption have been excluded. Recognition of azole exposure as a risk factor for increased MICs and for cross-resistance is key to selecting appropriate alternative therapy.

Incidence of Venous Thromboembolism (VTE) at Sunnybrook Long Term Care

Froozan Amin[1], Larry Jackson[2], Tracy Chan[3]
[1]Long Term Care Pharmacist, Sunnybrook Veterans Centre, Toronto, [2]Long Term Care Pharmacist; Clinical Coordinator, Sunnybrook Veterans Centre, Toronto, [3]Pharmacy Student, University of Toronto, Toronto, ON

Rationale: Venous thromboembolism (VTE) is an important cause of morbidity and mortality in hospitalized medical patients. Hospitalization itself causes an 8 fold increase in the risk of VTE. Large randomized clinical trials showed safety and efficacy of pharmacological prophylaxis in hospitalized medical patients (50-60% decrease in VTE) with lowest bleeding risks. However, little is known of the VTE risk among patients residing in long term care (LTC) settings.
Description of the Project: An observational study was performed in a 511-bed LTC facility to characterize VTE incidence. Evidence-based guidelines exist for hospitalized medical patients; however there is not enough evidence or guidelines for medically ill Long Term Care patients.
What was Done: Data on all new VTE events occurring in LTC residents was collected during the period from January 2007 to February 2009. Data was also collected on demographic parameters, clinical status, diagnosis, coincident medications, use of anticoagulant or antiplatelet medications and requirement for transfer to acute care.
Evaluation: Results showed 23 new VTE cases of which 21 cases were deep vein thrombosis (DVT) alone, 1 case of pulmonary embolus (PE) and 1 case of DVT + PE. Less than 20% of patients were on anticoagulant prophylaxis at time of the VTE event. All patients had 1 or more risk factors for VTE. The most common risk factors found were immobilization, acute change of health status and cancer.
Importance to Practice: Elderly patients residing in LTC facilities with risk factors including immobility, an acute change in health status and cancer appear to be at increased risk of VTE. Clinicians may consider short-term pharmacological prophylaxis for selected patients, especially those who experience an acute change of health status. However, there is no evidence for the efficacy or cost-effectiveness of primary prevention after the first 3 months of immobilization.

Aortic Graft Vancomycin Intermediate Resistant *Staphylococcus aureus* Infection Treated with Ceftobiprole after Linezolid Induced Peripheral Neuropathy

Christina Candeloro, Kim Delamere
London Health Sciences Centre, London, Ontario

Rationale: With the emergence of vancomycin intermediate resistant Staphylococcus aureus (VISA) infections antibiotic selection is becoming increasingly difficult. Ceftobiprole, an advanced generation cephalosporin demonstrates in-vitro activity against methicillin-resistant Staphylococcus aureus (MRSA) and VISA and was recently approved for use in complicated skin and skin structure infections (cSSSI). We report a case of safe and effective off-label use of this new cephalosporin in treating a VISA infection.
Description: A 45-year old male received vancomycin post Bentall procedure after developing an MRSA aortic graft infection. Over a 13 month vancomycin treatment period, increasing MICs were observed with emergence of VISA (MIC 4 mg/L) from blood cultures. Linezolid 600 mg i.v. q12h was started and 3 months later the patient presented with paresthesias of the distal lower limbs limiting mobility. The polyneuropathy was temporally linked with linezolid, other drug and physiologic causes were ruled out, and linezolid was discontinued. Alternative agents were considered but ceftobiprole was chosen as salvage therapy. Ceftobiprole 500 mg i.v. q8h administered over 2 hours was initiated for 50 days. Signs and symptoms of infection and blood cultures remained negative throughout ceftobiprole treatment. No serious adverse effects were observed.
Evaluation of the Literature: Two published randomized controlled trials of ceftobiprole in humans have demonstrated noninferiority to vancomycin +/- ceftazidime in cSSSI. Several clinical efficacy trials for pneumonia are awaiting publication. To date there are no published, unpublished or currently recruiting efficacy trials of ceftobiprole in cardiovascular infections. Nausea and dysgeusia are the most commonly reported adverse events.
Importance to Pharmacy Practitioners: Ceftobiprole represents a new and potentially safe alternative in treating MRSA and VISA infections.

Nephrotoxicity Associated with Tenofovir: A Systematic Review of Observational Studies

Amanda Chan[1], Mark Duffett[1,2], Alissa Koop[3]
[1]Department of Pharmacy, [2]Department of Pediatrics, and [3]Special Immunology Services Clinic, McMaster University Medical Center, Hamilton, ON

Rationale: The incidence and significance of nephrotoxicity associated with tenofovir when used to treat HIV is unknown. In clinical trials, it is rare (<1%) and reversible. Observational studies and anecdotal reports suggest that rates are higher in clinical practice.
Objective: The objective of this study was to estimate the rate of tenofovir-associated nephrotoxicity in HIV-positive adults.
Study Design and Methods: We searched Medline, Pubmed, EMBASE and hand-searched references of included articles. We included observational studies that enrolled HIV patients who were taking tenofovir on a regular basis, included a control group and measured baseline renal outcomes. Methodological quality was assessed for each study.
Results: Two prospective and three retrospective cohort studies reporting on a total of 3155 patients were included. Multiple methods of renal function assessment were reported, precluding pooling of the results. 0.9% – 12 % of patients in 2 studies of 971 patients developed renal toxicity (using the author's definitions), which was not significantly different from patients who did not receive tenofovir. Renal function as assessed by serum creatinine, creatinine clearance or glomerular filtration rate was significantly reduced in the tenofovir group in 4 studies including 1945 patients. Tenofovir discontinuation due to changes in renal function occurred in 1 – 7.5% of patients (1985 patients in 4 studies). In addition, two studies performed multivariate analysis and found that treatment with tenofovir was independently associated with a decline in creatinine clearance.
Conclusions: Tenofovir is associated with decreased renal function, which may result in changes in therapy. Renal toxicity is more common in clinical use than in clinical trials but the risk is low. Our estimate is likely conservative as clinicians may avoid tenofovir in higher risk patients or modify therapy based on a rise in serum creatinine before clinical nephrotoxicity occurs.

Safety Audit of Automated Dispensing Cabinets

Carole Goodine
River Valley Health, Fredericton, NB

Rationale: River Valley Health utilizes automated dispensing cabinets (ADCs) for ward stock and narcotic control. Safety Alerts issued by the Institute for Safe Medicine Practices (ISMP), availability of best

practice guidelines and local restocking errors prompted a review of ADC restocking processes in early 2008.
Process Review: The ADC restocking process was observed and discussed with lead technicians. Literature review identified frequent pharmacy errors associated with ADCs, and an audit tool was designed to identify pharmacy errors and to ensure compliance with best practice guidelines. Initial audit of 3 ADCs led to modifying the audit tool for ease-of-use and the remaining 8 ADCs were audited. Five lock-lidded and 5 open matrix pockets were checked in each ADC for correct medication, correct expiry date in the computer, correct count and to screen for pockets out of stock or containing expired product.
Results: Audits revealed 2 occurrences of incorrect medication, 7 incorrect counts, 43 incorrect expiry dates recorded, 1 unit dose package of expired medication and 2 pockets out of stock. Additional concerns identified include:
- Several unit dose oral syringes missing labels.
- One cabinet contained an entire quadrant of benzodiazepines requiring cabinet reconfiguration.
- Look-alike drugs atropine and zuclopenthixal acetate injection were in adjacent open matrix pockets in 1 cabinet and lidocaine with epinephrine and lidocaine without epinephrine were located in the same drawer in another cabinet.
- Two products were labeled in a confusing fashion.

Safety Improvements: ADC stock was moved to separate look-alike and sound-alike medications, staff were reminded of the importance of maintaining accurate expiry dates in the system, and discrepancies between nomenclature on the computer screen and drug product labeling were resolved. The pharmacy-nursing committee will perform quarterly ADC audits.

Encore Presentation

The Development and Evaluation of a Student Pharmacist Clinical Teaching Unit Utilizing Peer Assisted Learning

Adrienne J Lindblad,[1] Jason M Howorko,[1] Richard P Cashin,[1] Cornelius J Ehlers,[2] Cheryl E Cox[3]
[1]Pharmacy Department, Red Deer Regional Hospital Centre, Alberta Health Services, Red Deer, AB
[2]Knowledge Management, Red Deer Regional Hospital Centre, Alberta Health Services, Red Deer, AB
[3]Faculty of Pharmacy and Pharmaceutical Sciences, University of Alberta, Edmonton, AB

Rationale: Requests for student experiential placements have been increasing both in number and length. New models for experiential education in hospitals and related settings are needed to increase student experiential placement capacity without compromising patient care, educational quality, or preceptor workload.
Description: A student pharmacist clinical teaching unit (CTU) was developed to increase the preceptor to student ratio from 1:1 to a maximum 1:6. The CTU model incorporated staggered rotation start dates, longer rotation durations, and peer assisted learning.
Implementation: Five final year students participated in the CTU from January – April 2009 in 2 overlapping 9-week rotation blocks. The students started at staggered times to provide continuous coverage on the unit and allowed the more experienced students to mentor incoming students. Students cared for individually assigned patients and critically reviewed the work of their peers prior to preceptor review. Daily CTU team rounds allowed the students to present their patients to the pharmacy team to facilitate discussion and improve clinical reasoning skills. Three pharmacists rotated precepting activities in 3-week blocks as per the usual pharmacist schedule.
Evaluation: Program evaluation was accomplished through surveys of students and preceptors as well as the collection and evaluation of workload statistics. Preceptors reported no increase in workload burden. Workload statistics revealed that more drug-related issues were documented during the CTU compared to the same time period the previous year (768 and 151, respectively). Both students and preceptors were satisfied with the CTU and felt that the students' confidence, independence, judgment skills, time management skills and responsibility were increased compared to the traditional 1:1 preceptorship model.
Importance: Increasing the student preceptor ratio and utilizing peer assisted learning through the development of a student pharmacist CTU increases experiential training capacity, enhances the quality of the educational experience, and expands the level of pharmaceutical care for patients.

Potential Interaction between Warfarin and a Chinese Herbal Product "Qingreling" Resulting in a Bleeding Event

Derrick Kwan, George Dresser, Natalie Crown
London Health Sciences Centre, London, ON

Rationale: There are few documented reports of warfarin-herb interactions outside of cranberry, vitamin E, St. John's wort, devil's claw, garlic, ginseng and ginkgo. We present a possible interaction involving warfarin and a chinese herbal product, Qingreling containing radix scutellariae, fructus forsythiae, folium isatidis, and radix glycyrrhizae.
Description: A 74 year old male with atrial fibrillation on warfarin presented to the emergency department with a 2 day history of melena and abdominal discomfort. Laboratory investigations revealed a hemoglobin of 57 g/L and INR over 10. The patient's warfarin dose was stable at 23 mg/week with INR of 2.7 10 days prior. The patient denied alcohol use, changes to eating patterns or significant illness. He began taking Qingreling 4 days prior for symptoms of headache and nasal congestion. Management included discontinuing Qingreling, vitamin K administration and blood transfusion. Endoscopy revealed only mild esophagitis and colonoscopy was unremarkable.
Assessment of Causality: The supratherapeutic INR was observed within days of beginning Qingreling. It was stopped on admission and warfarin was subsequently restarted with stable INRs on 21 mg/week. No further supratherapeutic INRs or bleeding was observed. The Drug Interaction Probability Scale indicates a possible drug interaction with a score of 4.
Evaluation of Literature: No documented case reports of Qingreling interacting with warfarin exist, however two of its constituents could theoretically augment the effects of warfarin. Radix glycyrrhizae contains coumarin derivatives, and could theoretically elevate INR. In vitro data suggests that flavonoids found in scutellariae can reversibly inhibit CYP2C9, the enzyme responsible for S-warfarin metabolism. No pharmacologic basis for interaction was found for the remaining ingredients.
Importance of Case to Pharmacy Practitioners: Patients receiving warfarin therapy should be counseled to consult with their pharmacist prior to beginning any new medication. Through increased reporting of warfarin-herb interactions, it is hoped adverse reactions can be prevented.

Medication Reconciliation across the Spectrum of Renal Care and across the Province

Dan Martinusen
Royal Jubilee Hospital, Victoria, BC and the British Columbia Provincial Renal Agency

Medication reconciliation has been noted to improve patient outcomes. Dialysis patients may well be one of the highest risk groups for medication misadventures. The average dialysis patient prescribed 13 medications by multiple prescribers resulting in many daily doses. Moreover, these prescriptions change frequently given the acuity of this patient population. Given the fragility of these patients, the consequences of medication misadventures can be severe and is one the causes of the frequent hospitalizations seen in this group.

The BC Provincial Renal Agency embarked upon an ambitious project to develop medication reconciliation and then to spread it to all dialysis patients in the province, with future expansion to transplant and pre-dialysis patients. Central to the system is the Agency's "PROMIS" database that includes medication orders. Reports can be produced that enable medication reconciliation, medication profiles, hospital admission and discharge medication prescriptions.

260 reconciliations were performed demonstrating an average of 19 medication orders. First reconciliation encounters demonstrated an average of 6.3 discrepancies requiring an average of 6.8 orders to resolve them. Second reconciliation encounters with patients identified 2 discrepancies on average and 2.7 orders written to resolve them. Medication reconciliation using this system resulted in a dramatic reduction in discrepancies. Additionally, we demonstrated that on repeat reconciliations at six months, the number of discrepancies identified was dramatically lower.

This unique approach allows for continuous reconciliation in the outpatient setting that flows through to hospital admission and discharge to any hospital in the province. Reconciliation occurs at least every six months and can be flexible to be nurse, pharmacist, pharmacy technician or prescriber driven.

Patients benefit from improved safety and outcomes. Prescribers benefit by having accurate medication profiles, having accurate hospital admission and discharge orders available easily. The Agency benefits through improved medication data to correlate outcomes to demonstrate and drive best practice.

This poster links directly with CSHP 2015 initiatives (Goals 1, 2, 5.5, 5.6 and 6.1)

Encore Presentation

Retrospective Assessment of the Effectiveness of Standard vs. Non-standard Preoperative Antibiotics in Preventing Postoperative Surgical Site Infections in Elective Colectomy Patients

Irina Rajakumar, John Baskette, Anne Marie Bombassaro
London Health Sciences Center, London, ON

Rationale: Appropriate prophylactic antibiotics administered before colorectal surgery significantly decrease rates of surgical site infections (SSI). Inappropriate antibiotic use, however, can lead to increased microbial resistance, adverse events and costs.

Objectives: The objectives of this review were to compare the effectiveness of standard versus non-standard prophylactic antibiotics in preventing postoperative SSI and to assess compliance with Safer Healthcare Now guidelines for appropriate use of prophylactic antibiotics.

Methods: A retrospective chart review was conducted for adult elective colectomy patients between November 2008 and April 2009. Antibiotic use on or after postoperative day three, excluding treatment of other documented infections, was used as an indicator for SSI. Incidence of SSI, antibiotic costs, length of stay, readmission within 30 days, and percent of patients with appropriate antibiotic selection, timing, and discontinuation were recorded.

Results: Of the 101 patients whose charts were reviewed, 80 (79%) had received institutional standard prophylactic antibiotic regimen (cefazolin plus metronidazole). The majority of non-standard antibiotics consisted of the combination of ciprofloxacin and metronidazole (17 of 21). Postoperative antibiotic use was similar between the standard and non-standard groups, 33.8% and 33.3% respectively. No statistically significant difference was observed between groups in SSI rates, antibiotic costs, length of stay, and readmission. Time of preoperative antibiotic administration was documented in 96 of 101 patient charts. Seventy two percent (70/96) of antibiotic administration occurred within 60 minutes of surgery. Significantly more patients in the non-standard group received their preoperative antibiotic doses on time (100% versus 66%, p=0.0014). Sixty nine percent (70/101) of patients had prophylactic antibiotics discontinued within 24 hours after surgery.

Conclusion: In patients undergoing elective colorectal surgery, no difference was observed in the postoperative antibiotic use between standard and broader spectrum non-standard prophylactic antibiotics. Rates of appropriate antibiotic selection, timing of administration and discontinuation were below targets established by guidelines.

Post-Hospital Discharge: Medication Discrepancies and Drug Therapy Problems in Primary Care

Karen Cameron[1], Victoria Siu[2], Patricia Marr[1], Bassem Hamandi[2], Olavo Fernandes[2]
[1]Toronto Western Hospital Family Health Team, Toronto, ON
[2]Toronto General Hospital, Toronto, ON

Background: Patients transitioning from hospital to home are at risk of post-discharge medication discrepancies and drug therapy problems (DTPs). Differences between medications taken by patients at home compared to prescribed directions often lead to medication errors and adverse events after acute care discharge. At the time of our study, Toronto Western Family Health Team (TWFHT) did not have a formal, standard practice for post-discharge medication management. Further, the role of family health team pharmacists in post-discharge care had not been described in published literature. Therefore we sought a better understanding of the frequency and characteristics of post-discharge discrepancies and DTPs.

Objectives: To determine the number of patients with at least 1 discrepancy requiring clarification and those with at least 1 DTP linked to medication information transfer within 14 days post-discharge. Secondly, to characterize discrepancies, DTPs and report their status at follow-up within 45 days post-discharge.

Method: Patients admitted for > 48 hours and discharged from a hospital were identified. Patients discharged to nursing home, another institution or not actively visiting TWFHT were excluded. The study process involved a pharmacist visit scheduled within 14 days post-discharge. At this visit, a pharmacist conducted medication reconciliation and a pharmaceutical care assessment to identify discrepancies and DTPs respectively. Medication discrepancies were classified by standard types and contributing factors. DTPs were assessed for link to medication information transfer and classified according to seven standard categories. Follow-up encounters within 45 days post-

discharge were conducted to determine the status of identified discrepancies and DTPs.
Results: From February to June 2009, 30 patients were included in the study. At the initial visit, 24 (80%) patients had at least 1 discrepancy requiring clarification and 23 (77%) had at least 1 DTP linked to medication information transfer. The most common types of discrepancies were differences in drug 27 (52%) and dose 14 (27%). Patient and system factors appeared to contribute equally to discrepancies. Of all the DTPs identified, 50% were linked to medication information transfer. The most common DTPs linked to information transfer were 22 adverse drug events (35%) and 13 dose being too low (18%), with a similar trend in all DTPs observed.
Conclusion: Medication discrepancies and DTPs linked to medication information transfer occur commonly after hospital discharge. It is incumbent upon primary care practitioners, including family health team pharmacists to understand and develop ways to optimize post-discharge safety. Ultimately, a medication management strategy after acute care discharge should incorporate both medication reconciliation and pharmaceutical care.

The Safety of Ethanol Infusions for the Treatment of Methanol or Ethylene Glycol Ingestion: An Observational Study

Mary Kate Wedge, Sabrina Natarajan, Christel Johanson, Rakesh Patel, Andrew Gee, Salmaan Kanji
The Ottawa Hospital, Ottawa, ON

Rational: Methanol or ethylene glycol ingestion can result in significant morbidity or death unless prompt evaluation and treatment is initiated. Despite traditional and widespread use of ethanol as antidotal therapy, the safety of infusions is not well described. Current guidelines promote the use of fomepizole as preferred therapy for toxic alcohol ingestions. An evaluation of the safety and ease in titrating ethanol infusions is necessary given the availability of an alternative antidote.
Objective: To evaluate the safety and ease in titrating ethanol infusions for the treatment of methanol or ethylene glycol poisonings in a retrospective observational study.
Study Design and Methods: Hospital records of adults seen in the Emergency Department of The Ottawa Hospital for the treatment of methanol or ethylene glycol ingestion were reviewed for a 10-year period. Data with respect to patient demographics, severity of illness, ethanol dose titration, adverse events, and patient outcomes was collected by a single investigator using a standardized case report form.
Results: Data was analyzed using SPSS version 16.0. Overall, 154 patient records were reviewed, and 66 patients with toxic alcohol ingestions were included in the analysis. Fifty-two patients were treated with ethanol infusions. At least one adverse event was identified in 83% of ethanol-treated patients. During the infusion, the median [range] number of ethanol serum concentration measurements was 6.5 [0-24.0]. Only 164 of the 404 ethanol levels measured were within the target range, and 41% were followed by an inappropriate dose response to a non-therapeutic ethanol serum concentration.
Conclusion: These results suggest that adverse events are common with intravenous ethanol infusions and current practice for dose titration is inefficient. Despite the lack of superiority evidence in favor of fomepizole over ethanol, fomepizole may be a safer and easier antidote to administer.

Serotonin Syndrome with Venlafaxine after Change from Peritoneal Dialysis to Hemodialysis

Krista Biederman, London Health Sciences Centre, London, ON
Amanda Cherry, London Health Sciences Centre, London, ON

Rationale: Depression is seen in up to 1/3 of patients with chronic kidney disease and the use of antidepressants in this population is common. Venlafaxine is indicated for the treatment of depression and has also been implicated in reports of serotonin syndrome (SS). Venlafaxine and its active metabolite are renally cleared. Venlafaxine is not cleared by intermittent hemodialysis (IHD) and currently there is no literature to describe its clearance via peritoneal dialysis (PD).
Description: A 59 year old male with end-stage renal disease presented to the hospital with a 7 day history of altered mental status, tachycardia, vomiting, hallucinations, violent behavior and myoclonus of the limbs and face. Less than 3 weeks before admission the patient's dialysis was switched from PD to IHD. Prior to admission the patient was stable on venlafaxine 225mg daily for at least 2 years. Venlafaxine was held on admission. Within 48 hours, there was a dramatic improvement in most symptoms described with complete resolution of myoclonus on the third day.
Assessment of Causality: A temporal relationship between the change in dialysis modality and onset of symptoms was identified. The patient showed marked improvement in symptoms 48 hours after venlafaxine was discontinued. The Naranjo Probability Scale yields a score of 4, suggesting a possible adverse drug reaction. Venlafaxine was not re-administered.
Evaluation of Literature: There are reports of venlafaxine-associated SS. The time frame of resolution is consistent with other case reports of venlafaxine-associated SS. There are no case reports specifically of SS associated with venlafaxine after a change from PD to IHD.
Importance to Pharmacy Practitioners: It is important for pharmacists to understand the potential for differences in drug clearance between dialysis modalities and resultant adverse drug effects such as serotonin syndrome in patients who are changing dialysis modalities.

Interventions in a Medical Teaching Unit: Effect of a Pharmacist Attending Rounds versus Reactive Patient-Care Efforts (INTERVENE)

Zack J Dumont, Regina Qu'Appelle Health Region Department of Pharmacy Practice Regina, SK, Lynette Kolodziejak, Regina Qu'Appelle Health Region Department of Pharmacy Practice, Regina, SK, Nicole Bidwell, Regina Qu'Appelle Health Region Department of Pharmacy Practice, Regina, SK, Alexandra Martinson, Regina Qu'Appelle Health Region Department of Pharmacy Practice, Regina, SK

Rationale: Research has shown that pharmacist participation on rounds may decrease medication errors, adverse drug events, and drug costs.
Objectives: To determine the number, type, time taken to perform, and acceptance rate of pharmacist interventions performed during patient-care rounds on a medical teaching unit (MTU); to compare the interventions to activities shown in the literature to have a positive impact on patient-care; and to compare interventions between a control and study phase.
Design & Methods: A prospective, controlled trial. During the control phase pharmacists provided standard service to the MTU and did not attend patient-care rounds. During the study phase, pharmacists participated on daily MTU rounds in addition to providing standard services. Pharmacists recorded each intervention over four weeks; 2 weeks per phase. Interventions were categorized into activities identified in the literature to be of benefit to patients. Time

taken to perform interventions included work-up and wait-time for physician acceptance/rejection.

Results: Pharmacists performed 80 interventions during MTU rounds, 90% were accepted. Of the interventions identified in the literature to be of benefit the most commonly recorded were "recommending alternative therapy" (44 interventions, 82% accepted), "clarifying/correcting an order" (20 interventions, 100% accepted), and "providing drug information" (6 interventions, 100% accepted). On average, the time required per intervention was 12.4 minutes. During the control phase, pharmacists performed 18 interventions, 81% were accepted, requiring a mean of 177.2 minutes per intervention.

Conclusion: Proactive pharmacist participation on MTU patient-care rounds resulted in a larger, more efficient, number of beneficial interventions than reactive patient-care.

Quality Improvement Evaluation of a Pharmacist Managed Warfarin Dosing Service for Outpatient Venous Thromboembolism.

Patrick Fitch, Department of Pharmaceutical Services, Victoria General Hospital, Winnipeg, Manitoba; Julie Mistri, Department of Pharmaceutical Services, Victoria General Hospital, Winnipeg, MB; Alexander Persowich, Clinical Institute of Applied Research and Education, Victoria General Hospital, Winnipeg, MB

Rationale: We implemented a pharmacist managed warfarin dosing service for outpatients initiated on warfarin for treatment of venous thromboembolism, using one of two previously validated dosing nomograms (initial dose 5 mg or 10 mg) to guide warfarin dosing (expected therapeutic INR in 5 days). The purpose of the project was to evaluate the effectiveness of the service.

Description of Project: We conducted a retrospective audit of pharmacy profiles and patient charts for all patients admitted to the service between April 1, 2008 and March 31, 2009. Data abstracted included: demographic information; indication for anticoagulation; frequency of use of each nomogram; deviations from the nomogram and reasons for deviations; number of treatment days on each nomogram; number of patients with INR > 3.0 and interventions for INR > 3.0.

Evaluation: Fifty seven patients were included (mean age 62.2 yrs, 47.4% male). The primary indication for anticoagulation was deep vein thrombosis (82.5%). The majority of patients (64.9%) used the 10 mg nomogram. Eighty-six percent of patients achieved a therapeutic INR. Deviations from the nomograms were required for 52.7% of patients to achieve therapeutic INR. The most common reasons for deviation from the nomograms were: treatment duration exceeding nomogram duration (21%); INR not rising fast enough (28.9%); and INR rising too fast (13.1%). The time to achieve target INR was longer than that reported in previous studies using these or similar nomograms. No patients had an INR greater than 4.5 or required vitamin K.

Conclusions: Our pharmacist managed warfarin dosing program is a safe, effective method of initiating warfarin therapy in outpatients requiring anticoagulation. Additional investigation is required to determine reasons for the extended time required to achieve target INR. Pharmacist education is required to reduce the number of protocol deviations.

Release of Joint Technical Statement on Pharmaceutical Bar Coding in Canada

Robin Ensom, Regional Director, Pharmacy, Vancouver Coastal Health and Providence Health Care, Vancouver, BC; Ian Sheppard, Project Lead, Institute for Safe Medication Practices – Canada (ISMP-Canada), Toronto, ON; Pierrette Leonard, Senior Advisor – National Partners, Canadian Patient Safety Institute (CPSI), Ottawa, ON; Sylvia Hyland, Vice-President and Chief Operation Officer, Institute for Safe Medication Practices – Canada, Toronto, ON

Bar coding as a point-of-care scanning system, combined with a computerized database, ensures that the right drug, in the right dose and by the right route of administration, is being given to the right patient at the right time. Bar coding, when integrated with other advanced technologies, serves as an automated, reliable, and independent double check at the point of care, for prescriber order entry, and electronic medication administration records.

A multiphase project for pharmaceutical bar coding, co-led by CPSI and ISMP-Canada, is guided by an Implementation Committee composed of stakeholders, and supported by a 34-member Technical Task Force. A first outcome, recognizing the need for a national standard, was endorsement of the adoption of the GS1 global standard for automated identification of pharmaceutical products.

Multiple stakeholders have been involved to ensure that the development of a joint technical statement for pharmaceutical bar coding in Canada considered all healthcare sector requirements for implementing bar coding within the healthcare system. The statement also recognizes the evolutionary nature of the implementation process with advancing technologies and recognizing the varied levels of readiness in the healthcare sectors.

A 34-member Technical Task Force, with representation from pharmaceutical manufacturers, supply chain organizations, health and information technology, retail pharmacy, institutional pharmacy, and health standards organizations, and GS1 Canada, have reached consensus on a joint technical statement with requirements for bar code components and symbologies, medications included in bar code categories, packaging levels, and bar code placement.

Strategic alliances and stakeholder engagement for this national and comprehensive collaboration, envisioned to have multiple phases, will continue to be developed, including communication and sustainability strategies. Its purpose is widespread utilization of bar coding technology in order to add a layer of medication safety and to our healthcare system.

Organizations providing support and funding for the project will be acknowledged.

Qualitative Evaluation of the Canadian Fabry Disease Initiative

Mark Embrett[1], Neil J MacKinnon[2], Tom Rathwell[1], Daryl Pullman[3]
[1]School of Health Administration, Dalhousie University, Halifax, Nova Scotia
[2]College of Pharmacy, Dalhousie University, Halifax, Nova Scotia
[3]Faculty of Medicine, Memorial University, St. John's, Newfoundland and Labrador

Rationale: The Canadian Fabry Disease Initiative (CFDI) is a national study designed to assess the effectiveness of two treatment options for the rare Fabry disease. This initiative provides a unique opportunity for robust research that can contribute to a future Common Drug Review evaluation on these two treatments.

Objectives: (1) Evaluate the CFDI using input from key informants; and (2) determine the initiative's merit, assess its value and provide feedback to health professionals, patients and decision makers.
Study Design and Methods: This study used an ideal qualitative methods strategy composed of interview transcripts, a holistic-inductive design and content analysis. In May-June 2009, key informants, including CFDI patients, CFDI investigators, provincial and pharmaceutical representatives, were interviewed about their experiences with the CFDI. Content analysis was applied to identify core consistencies and meanings that allowed core themes to emerge and develop from the data.
Results: Eighteen participants were interviewed, resulting in nine within and four between group themes. Within group analysis suggested: (1) Patients are concerned about the restrictions a clinical trial placed on access to therapy; (2) CFDI investigators believe the database and monitoring are essential components to treating rare diseases, but the CFDI is not the ideal model; (3) Provincial representatives believe research should not be a foundation for drug access; and (4) Pharmaceutical representatives perceived the CFDI as a poorly designed answer to a reimbursement problem. Between group analysis revealed that the CFDI as an important initiative in Canada. However, it is not the solution to many of the issues related to reimbursement for expensive drugs for rare diseases.
Conclusion: Three conclusions emerged: (1) The CFDI was a temporary solution to a reimbursement problem, (2) No group was completely satisfied with the CFDI; and, (3) The CFDI can and should be redesigned to better accommodate each group's needs.

Safer Medication Use in Emergency Departments (SAFER MEDs)

Stacy Ackroyd-Stolarz[1,2], Neil MacKinnon[1], Peter Zed[1,2], Nancy Murphy[2]
[1]College of Pharmacy, Dalhousie University
[2]Department of Emergency Medicine, Dalhousie University

Rationale: Emergency Departments (EDs) frequently see patients for medication-related problems, yet there are there are few cost-effective ways to measure the extent of the problem on an ongoing basis to guide prevention strategies.
Objective: To demonstrate the feasibility of using routinely collected data to identify adverse drug events (ADEs) in patients presenting to EDs.
Study Design and Methods: This retrospective cross-sectional pilot study was conducted in four EDs in Capital District Health Authority from November 1, 2007 to October 31, 2008. The primary outcome measure was the occurrence of an ADE identified from the ED Information System using validated screening criteria.
Results: In 673 (0.5%) of 142,433 eligible patient records, an ADE was the main reason for the ED visit. Medications most frequently implicated in ADEs were analgesics and anti-pyretics (142 of 673 [21.1%]), psychotropic medications (121 [18.0%]), and other sedatives and hypnotics (95 [14.1%]). Patients presenting with an ADE were more likely female (57.7%, p=0.004) and younger (median age 37.0 vs. 43.0, p<0.0001). They were also more likely to be transported by ambulance (37.6% vs. 13.1%, p<0.0001), spend longer in the ED (4.5 vs. 3.1 hours, p<0.0001), be admitted to hospital (14.9% vs. 9.3%, p<0.0001) and an ICU (5.1% vs. 0.4%, p<0.0001).
Conclusion: Although the use of electronic data significantly underestimates ADEs treated in the ED, it nevertheless provides new information on events arising from a variety of care settings (e.g., primary or long-term care) that would otherwise not be captured. Differences in healthcare utilization underscore the value in identifying these ADEs. The information is routinely collected, readily available and accessible for low cost. Moreover, data can be obtained without any impact on clinical staff. These attributes increase the utility for ongoing system-level monitoring.

The Future Plans and Career Expectations of Pharmacy Students: Results from A National Survey

Sean D Higgins[1], Neil J MacKinnon[1], Janet Cooper[2], Heather Mohr[2], Kelly Hogan[2], Derek Jorgenson[3]
[1]College of Pharmacy, Dalhousie University, Halifax,
[2]Canadian Pharmacists Association, Ottawa, ON
[3]University of Saskatchewan College of Pharmacy and Nutrition, Saskatoon, SK

Rationale: Canada's pharmacy students are key stakeholders in the future of the profession. Students have critical insights about the future of pharmacy and important perspectives on pharmacy education, the labour market, and the skills and competencies required for practice.
Objectives: A survey was developed for Canada's pharmacy students to: 1. gain insight into the understanding and support for the future vision for the profession as outlined by the Blueprint for Pharmacy, and, 2. assess pharmacy students' future expectations as a pharmacy professional in relation to the vision.
Study Design and Methods: A web-based survey was developed as part of the Canadian Pharmacists Association's Moving Forward initiative, and was made available for all of Canada's undergraduate pharmacy students for approximately one month during October 2007. The survey contained seven questions addressing demographics, and 22 questions addressing the future plans and expectations and exposure to the job market.
Results: Based on the responses of the 1250 respondents, the amount of time students would ideally spend in direct patient care during their career is much greater than the amount of time they actually expect to spend doing so, while the opposite is true for amount of time spent in dispensing/distribution. While pharmacy students feel quite positive about both the quantity and quality of career opportunities, they often find it difficult to reconcile the realities of distribution-based pharmacy with the hope to practice pharmaceutical care.
Conclusion: Based on the insights into the future plans and career expectations of Canada's pharmacy students, it is clear that Canada's future pharmacists desire a practice model that closely emulates that outlined in the Blueprint for Pharmacy. Employers, educators and practicing pharmacists could use these results to gain a better understanding of the perspective of pharmacy students.

Perceived Demands for Practice Experiential Education: Results from a National Survey of Hospital Pharmacy Directors

Jason Howorko[1], Sean D Higgins[2], Neil J MacKinnon[2], Myrella Roy[3]
[1]Pharmacy Manager, David Thompson Health Region, Red Deer, AB
[2]College of Pharmacy, Dalhousie University, Halifax, NS
[3]Canadian Society of Hospital Pharmacists, Ottawa, ON

Rationale: Hospital-based practice experience is a key part of the education of pharmacy students in Canada. At same time, demands placed upon Canada's hospital pharmacy departments for experiential placements are growing due to the transition to entry-level PharmD (ELPD) programs and larger class sizes in many pharmacy programs.

Objectives: A survey was developed to: 1. gain insight into the concerns of hospital pharmacy directors related to pharmacy experiential education, and 2. assess the capacity to increase the number and length of student placements.
Study Design and Methods: A web-based survey was developed and made available to Canadian hospital pharmacy directors in May 2009. The survey contained questions addressing demographics, issues related to the capacity for student training to experiential training demands. Both quantitative and qualitative analyses were completed.
Results: Seventy-four hospital pharmacy directors completed the survey for a response rate of 35.9%, representing approximately 50,000 hospital beds. Only 14% of respondents indicated that their institution would be able to provide longer or greater numbers of clinical practice rotations for pharmacy students. The qualitative analysis revealed several concerns related to the lack of capacity to expand experiential training, as exemplified by the following quotes: "Lack of physical space and resources is a huge constraint" and "we already stretch our limited resources to take on as many students as possible, but if timing of rotations/season for rotations were more flexible we might be able to provide more training." The respondents are open to new innovative models of providing practical experiential training.
Conclusion: Hospital pharmacy leaders are committed to providing experiential education, but are concerned that they cannot meet future demands. These concerns result from lack of preceptors, financial constraints and other operational factors. It cannot be assumed that hospitals can take on more experiential education without significant changes to the system.

Comparison of Two Approaches to Antibiotic Stewardship

Karen Riley,[1,2] Lynn Nadeau,[1] Department of Pharmacy, [1]Hotel Dieu Grace Hospital and [2]Windsor Regional Hospital, Windsor Ontario

Rationale: The benefits of antibiotic stewardship programs include improvement to patient care and financial gains for the hospital. Several possible interventions have been proposed by the ISMP Ontario Antimicrobial Stewardship Project.
Description: We describe the processes used by 2 distinct hospitals within the same city to decrease antibiotic use.
Steps Taken: At site 1, an antibiotic review committee exists and an Infectious Diseases pharmacy specialist prospectively audits antibiotic use and provides feedback, and utilizes intravenous to oral stepdown and renal dosing medical directives. Defined Daily Dose (DDD) data is based on purchase data since individual patient data is not available. Site 2 aligned and reactivated its Infection Control Committee. Pharmacists follow similar medical directives to site 1. DDD is based on patient data.
Stewardship items implemented at the 2 sites are listed in Table 1.

Table 1: Stewardship Item	Site 1	Site 2
Implementation of antibiotic stewardship (AS) team	joint	joint
Prospective audit with intervention and feedback	yes-ID RPh	no
Retrospective audit and feedback	yes	yes
Drug use evaluations/reviews	no	yes
Formulary restrictions and preauthorization	yes	yes
Automatic stop orders	yes	yes
Education	yes	yes
Antimicrobial handbook	joint	joint
Academic detailing	no	no
Policies restricting non-academic detailing	no	no
Guidelines and clinical pathways	yes	yes
Antimicrobial order forms	yes	yes
Computerized order sets	no	no
Specific criteria for use of combination therapy	no	no
Streamlining or de-escalating	yes	no
Dose optimization	yes	yes
Parenteral to oral conversion	yes	yes
Automatic drug substitution polices	yes	yes
Guided therapy in CPOE	no	no
Implementation of antibiograms	joint	joint
Restricted microbiology susceptibility reporting	joint	joint
Computer-aided screening of microbiology data	no	no
Implementation of short course antimicrobial therapy	no	no
Implementation of hospital scorecard on AS	no	no

Evaluation: Despite having similar programs in place for antibiotic stewardship, evaluation of the DDD data indicates that prospective audit and feedback performed by an Infectious Diseases trained pharmacist results in an overall reduction of antibiotic consumption by 27% at site 1 and an overall increase in antibiotic consumption by 16% at site 2.
Usefulness to Practice: Of the initiatives employed to provide antibiotic stewardship, results from these 2 institutions demonstrate that prospective audit and feedback appears to provide the greatest benefit in reducing antibiotic use.

Clinical Pharmacy Services Survey for Canadian Hospitals

Karen Riley, Antoinette Duronio
Department of Pharmacy, Hotel Dieu Grace Hospital, Windsor, ON

Rationale: A survey was developed to examine pharmacy services in Canadian hospitals and to create a benchmark for comparison to other institutions if developing a residency program.
Description: Directors of Pharmacy from across Canada were asked to complete a survey which examined specific questions about clinical pharmacy services, antimicrobial stewardship programs, and the uptake of technologies to improve medication safety. In contrast to the Lilly survey, our survey focused on clinical pharmacy aspects and programs within institutions.
Steps Taken: The survey was developed using criteria from previous studies examining clinical pharmacy services in the United States, antimicrobial stewardship programs, and uptake of technologies in Canada. Surveys were distributed to the directors of pharmacy of hospitals within Canada. Respondents will receive a blinded copy of all surveys completed.
Evaluation: Approximately 24% of institutions surveyed responded (n=34). Roughly 40% of respondents were from hospitals with greater than 400 beds compared to 60% of hospitals with less than 400 beds. Respondents were from all provinces except Saskatchewan. Small differences in numbers of pharmacotherapy specialists and drug protocols were observed between larger community and teaching hospitals. Little difference between community hospitals over 300 beds compared to teaching hospitals exceeding 400 beds was detected with respect to the number of Pharm Ds, pharmacotherapy specialists, director credentials or the number of pharmacist-managed drug protocols. (see Table 1)

TABLE 1: CRITERIA	ALL	<200	201-300	301-400	>400	T	C	I
No. of survey responders per category	34	9	5	7	13	10	24	
% of community hospitals	70	100	100	100	39			
% BScPharm	84	97	92	88	83	84	91	44
% Pharm D	16	3	8	12	17	16	9	56
% BScPharm directors	64	78	80	57	54	70	63	no
% advanced degree directors	36	22	20	43	46	30	37	yes
% hospitals with ABS	38	22	40	43	46	50	33	yes
Ave no. of pharmacy specialists	3.2	1	1	4	5	6	2	6
% hospitals with residencies	29	22	0	29	46	70	13	no
% of hospitals with CPOE	20	14	0	29	31	40	13	no
% of hospitals with competency testing	14	22	0	14	15	10	17	yes
Average no. of pharmacist managed drug protocols	1.5	0.9	1.2	1.7	2.5	2.2	1.5	6

T=teaching hospitals, C=Community, I=investigator community hospital ABS=antibiotic stewardship programs

Usefulness to Practice: With the thrust to develop more residency programs in order to increase residency-trained hospital pharmacists, as encouraged in the 2015 CHSP goals, hospital pharmacies can benchmark their own activities against teaching hospitals or hospitals with similar demographics that already have residency programs in place.

Implementation of a Preoperative Atrial Fibrillation Prophylaxis Protocol by a Pharmacist with Medical Directives Improves Clinical Outcomes

Y Shamiss, Y Khaykin, T Elmowafy, R Khaykin, M Beardsall, S Martin, S Skerratt, B Pick, L Hutchinson, L Heinrich, A Verma, Z Wulffhart, C. Peniston
Southlake Regional Health Center, Newmarket, ON

Objective & Rationale: Atrial fibrillation (AF) is a complication of cardiovascular surgery (CVS) can be associated with increased length of stay (LOS) and higher mortality. Prophylactic administration of Amiodarone and beta blockers (BB) has been shown to reduce the incidence of postoperative AF. Translation of this evidence into clinical practice has not been assessed.
Methods: To evaluate the utility of a preoperative AF prophylaxis algorithm routinely applied by a Pharmacist supported by medical directives vs standard care, baseline, procedural and outcomes data were prospectively collected on 59 consecutive patients scheduled for CVS 05/2008-07/2008 who were assessed and treated by a pharmacist at the preoperative clinic and a historic cohort 249 consecutive patients undergoing CVS 01/2006-08/2006 without a pharmacist intervention.
Results: 5 of the pharmacist's patients and 12 of the historical patients were in permanent AF and were excluded. Baseline characteristics did not differ (76%male, average age66 +/-11yrs, LAD42+/-6mm, EF 1.5/4, NYHA 1, diabetes 30%, AF history13%, hypertension 60%). Pharmacist's patients were more likely to have valve surgery alone (17% vs 5%, p=0.01) and less likely CABG alone (50vs.81%, p<0.001). While there were no differences in administration of cardiac medications including ASA(70%), BB(75%), ACEI(57%) and statins(75%), only 7% of the patients treated under usual care received amiodarone prophylaxis vs. 46% treated by the pharmacist (p<0.0001). Pharmacist's patients were less likely to have postoperative AF> 4hours (9%vs27%,p<0.001) and had a shorter LOS (4.5+/-1.7days vs 6.4+/-5.3days, p<0.001). Pharmacist treated patients were not more likely to have bradycardia or postoperative pacing.
Conclusions: Implementation of a preoperative AF prophylaxis by pharmacist supported by medical directives, improved adherence to guidelines, leading to more patients appropriately receiving amiodarone and a lower risk of postoperative AF with a shorter LOS post CVS. Further study into this interdisciplinary model of care is warranted in this patient population.

Projet pilote d'implantation d'un suivi systématique de la clientèle asthmatique et maladie pulmonaire obstructive chronique en pharmacie communautaire

Delphine Bercier[1], Frédéric Julien-Baker[2], Lucie Blais[3], Lyne Lalonde[3], Marie-France Beauchesne[3]
[1]Pharmacie Jean-François Guévin, Montréal, QC
[2]Pharmacie Marc Champagne, Montréal, QC
[3]Faculté de pharmacie, Université de Montréal, Montréal, QC

Titre : Projet pilote d'implantation d'un suivi systématique de la clientèle asthmatique et ayant une maladie pulmonaire obstructive chronique en pharmacie communautaire.
Introduction : L'implantation d'un programme de suivi de la pharmacothérapie par le pharmacien communautaire pourrait améliorer la maîtrise de l'asthme et de la maladie pulmonaire obstructive chronique (MPOC), mais ceci ne semble pas avoir été évalué au Québec.
Objectifs : Évaluer la faisabilité d'implanter un suivi systématique (SS) de la clientèle asthmatique et MPOC en pharmacie communautaire et secondairement évaluer l'impact préliminaire de ce programme sur la maîtrise de ces maladies.
Méthodes : Après avoir reçu une formation, les pharmaciens participants ont recruté des patients asthmatiques et MPOC adultes admissibles au projet (qui prennent de façon régulière des médicaments pour le traitement de l'asthme ou de la MPOC) à leur pharmacie communautaire. Les étapes du SS étaient planifiées sur 3 rencontres (à 0, 3 et 6 mois) et comprenaient l'évaluation de la maîtrise de la maladie, de la technique d'inhalation ainsi que l'enseignement au patient.
Résultats : Au total, 19 pharmaciens ont participé au projet, et 13 de ceux-ci ont recruté 35 sujets. Plus de 75% des étapes prévues dans le SS ont été appliquées, et les pharmaciens ont rédigés un total de 19 opinions pharmaceutiques pour lesquelles 31 suggestions ont été émises au médecin traitant. Une diminution statistiquement significative de 0,058 exacerbations par patient-mois de MPOC et une amélioration de 13,72% statistiquement significative de la technique d'inhalation pour l'ensemble des sujets ont été observées. De plus, les résultats indiquent une amélioration (différence numérique) de la maîtrise de la maladie (asthme et MPOC), du nombre de patients ayant visité un centre d'enseignement, et de la possession d'un plan d'action. Il n'y avait pas de différence statistiquement significative pour l'adhésion au traitement.
Conclusion : Ces résultats préliminaires sont favorables à l'implantation du SS en pharmacie communautaire et l'impact semble prometteur sur la maîtrise de l'asthme et de la MPOC.

Stability of Piperacillin/Tazobactam (Apotex) in Polyvinylchloride Bags and Polypropylene Syringes

Ronald F. Donnelly, The Ottawa Hospital, Ottawa ON

Rationale: The product monograph for buffer-free, EDTA free piperacillin/tazobactam (Apotex) states that small volume infusions should be used immediately after preparation. These recommendations do not allow for batch production of minibags or syringes in a CIVA setting.
Objectives: To determine the physical compatibility and chemical stability of solutions containing buffer-free, EDTA free piperacillin/tazobactam (Apotex) packaged in PVC bags and stored at 5 °C and PFL over a 28 day period or polypropylene syringes store at 5°C or -10°C (7 days).
Methods: On day 0 vials of piperacillin/tazobactam were reconstituted with SWI and then further diluted, in triplicate, to either 22.5 or 90 mg/mL with either D5W or NS and stored in PVC minibags. Separate vials were diluted with SWI to 150 mg/mL and packaged in polypropylene syringes. After sample collection on day 0, containers were stored at either 5°C or -10°C and protected from light. Subsequently on days 7, 14, 21 and 28, samples were collected and analyzed in duplicate. Analysis was conducted using a validated stability-indicating HPLC method. Physical compatibility was accessed by monitoring color, clarity and pH.
Results: All samples remained clear and colorless through day 28 of the study. There was only a slight change in pH (≈0.6 pH units) over the course of the study with a trend towards becoming more acidic. There was a slight difference in stability based on concentration of piperacillin with the more dilute solutions being the most stable.
Conclusions: Both concentrations of piperacillin/tazobactam solution were found to be physically compatible and chemically stable in either D5W or NS in PVC bags for 28 days when stored at 5°C and PFL. Solutions diluted with sterile water for injection and packed in polypropylene syringes were stable for 7 days when frozen at -10°C and 21 days when stored at 5°C and PFL.

Review of the Critical Care Insulin Nomogram Used at Lakeridge Health Oshawa (LHO)

Dr. L. Huzel, RCPSC Internal Medicine & Respirology, Critical Care Physician Leade
Paddy Grayhurst RPh, Professional Practice Leader, Pharmacy Services
Michelle Hung, Pharmacy Student, Lakeridge Health Corp, Oshawa ON

Background: Interest in intensive insulin therapy (IIT) was created by the results of vanden Berghe's 2001 study "Intensive Insulin Therapy in the intensive care unit" in ventilated surgical ICU patients. In 2006 LHO approved the use of an Insulin Nomogram based on literature and the experience of critical care units in our geographical area. Despite the frequency of its use, the Insulin Nomogram was not readily accepted by nursing and physician staff. The publication of the NICE-SUGAR trial in March 2009 prompted a review of our nomogram results.
Methods: A review of 21 charts was completed. Data collection included blood sugar results, insulin rate and adherence to the nomogram, factors that may have influenced pronounced blood sugar changes such as drug or IV changes. Critical care nurses were surveyed for their impressions of the effectiveness, safety and ease of use of the nomogram.
Results: The definition of euglycemia at LHO differs from van den Berghe's. Target blood sugar is 5.1-8 mmol/L. Euglycemic results were documented 40.2% of the time, hyperglycemia 46.2% including the reading prior to initiating the nomogram. Hypoglycemia as documented in 13.6% of readings with all defined as mild or borderline. No blood sugars 2.2 mmol/L or lower were recorded. Re-examining the data using an adjusted target blood sugar of 5.1-10 mmol/L, incorporating a recommendation of the NICE-SUGAR trial, euglycemia increased to 58.3%, hyperglycemia falls to 28.1% with hypoglycemic results unchanged. Nursing indicated the nomogram is complex, requiring careful review even by experienced RNs prior to each intervention. Nursing requested that their rofessional judgement be built into the nomogram.
Conclusions: The insulin nomogram in use at LHO appears to be effective in lowering elevated blood sugars without inducing hypoglycemia. Efforts to simplify the document and incorporate NICE-SUGAR and nursing recommendations are underway.

How Long Does Medication Reconciliation Take?

Sara Ingram, Sassha Orser, Rajini Retnasothie, Olavo Fernandes
University Health Network, Toronto, ON
Leslie Dan Faculty of Pharmacy, University of Toronto, Toronto, ON

Rationale: A common and practical inter-professional question in planning to implement admission medication reconciliation is: how much health care professional time is required to sustain this patient safety activity successfully? The purpose of this investigation was to determine the time required for various stages of the medication reconciliation (MedRec) process for admitted patients to 2 tertiary care teaching hospitals.
Description: Primary objectives were to define and quantify the time required for a pharmacist or a trained pharmacy student to complete admission MedRec for Emergency/General Medicine patients. Data was collected over a 4 week time period per pharmacist/student. Patients on whom MedRec had been completed during that time were included. Measurements included total time, as well as amount of time required for each step in the process, including: 1) information gathering 2) patient interview 3) documentation, and 4) discrepancy resolution. Timing differences related to level of training, or hospital site were also evaluated. Timing information was collected by the individual performing MedRec by estimating the number of 5 minute time intervals required to perform each of the tasks in the process.
Evaluation: Data was collected on 387 patients by 8 pharmacists and 2 pharmacy students from March-September 2009. The mean total time required for MedRec was 25.63 +/-9.01 minutes. The mean times for each stage were: information gathering (7.77+/-3.60), patient interview (6.61+/-4.76), documentation (6.60+/-3.11), and discrepancy resolution (4.65+/-3.00). No significant time differences were detected for type of clinician (pharmacist or student) or hospital site.
Importance: This study helped quantify time required to complete the MedRec process with trained pharmacy clinicians. Findings from this study can support effective hospital planning for clinician resources to implement MedRec as well as strategies to improve efficiency. A similar evaluation can be completed with other disciplines, including nursing.

Pharmacological Management of Amiodarone-Induced Thyrotoxicosis Type I in Mitral Valve Replacement

Joanne Lau, London Health Sciences Centre, London, ON
Rita Dhami, London Health Sciences Centre, London, ON

Rationale: Amiodarone-induced thyrotoxicosis (AIT) delays urgent cardiac surgeries as achieving euthyroidism may require months despite pharmacotherapy. Patients are at risk of thyroid storm if exposed to anesthesia and surgery while hyperthyroid. Multiple case reports demonstrate successful conversion to euthyroidism by thyroidectomy, however only one case report describes an AIT Type II patient undergoing urgent surgery without conversion to euthyroidism.
Description: A 53-year old female with atrial fibrillation, requiring urgent mitral valve replacement (MVR) for mitral valve stenosis and regurgitation had signs and symptoms of hyperthyroidism subsequently diagnosed as AIT Type I. Amiodarone was discontinued and methimazole was started, to no effect. The patient was then symptomatically controlled with propylthiouracil 200 mg TID, dexamethasone 2 mg BID, propranolol 80 mg BID, and pacemaker rate controlled. Thyroid levels improved modestly but remained elevated. Thyroidectomy could not be performed because MVR requiring anticoagulation was urgently needed. Post-MVR, signs and symptoms of thyroid storm were absent and the patient was successfully discharged.
Assessment of Causality: Resolution of hyperthyroid symptoms occurred with initiation of propylthiouracil, dexamethasone, and propranolol therapy. Treatment success of propylthiouracil over methimazole may be due to its mechanism of inhibiting T4 conversion to active T3.
Evaluation of the Literature: There is one case report of necessary surgery (excluding thyroidectomies to treat AIT) in unresolved AIT Type II. Propylthiouracil, prednisone, and propranolol achieved symptom control, but the patient remained hyperthyroid. Despite this, percutaneous tracheotomy was performed and the patient experienced recurrent thyrotoxicosis unresponsive to treatment and died 7 days later. The authors recommend thyroidectomy be performed with percutaenous tracheotomy in this setting.
Importance to Pharmacy Practitioners: Urgency of surgery may preclude rapid resolution of AIT by thyroidectomy. This case demonstrates the plausibility of pharmacologic resolution of hyperthyroid symptoms and suppression of thyroid storm peri- and post-surgery where thyroidectomy is not possible.

Venous Thromboembolism (VTE) Prophylaxis in Hospital Patients

Shelley McKinney, Lakeridge Health Corp, Oshawa ON

In December 2008, Lakeridge Health, a 538 bed community general hospital system with 3 acute care sites in Durham Region, Ontario, began the Venous Thromboembolism (VTE) Prophylaxis patient safety project for Medicine, General and Orthopaedic surgery inpatient services. The project was sponsored by the Medical Advisory Committee under the direction of an Inter-professional Taskforce including Director of Pharmacy, Chair of Pharmacy & Therapeutics Committee and Drug Utilization Pharmacist.

VTE is the number one preventable cause of mortality and morbidity in hospitals. Previously, LH participated in a research study which identified low rates of patients receiving appropriate pharmacological and mechanical VTE prophylaxis compared to clinical guidelines. Our low VTE rates created momentum to improve clinical performance and a comprehensive strategy was created. Pharmacy staff worked with clinicians to design interventions that would improve our VTE prophylaxis rates. Interventions included pre-printed admission orders with VTE prophylaxis options and a trigger tool report for daily VTE prophylaxis assessment to all hospital physicians. This report listed all patients on a specific floor with their VTE pharmacological prophylaxis. The project team initiated VTE awareness in the hospital through communiqués and educational sessions.

Continuous audits for medical, surgical and orthopaedic patients were also conducted to measure performance and compared to the baseline audits. These audits measured whether or not eligible patients were receiving appropriate VTE prophylaxis. At baseline, appropriate prophylaxis in medicine, surgery and orthopaedic groups was observed in 59/102 (58%), 34/72 (47%) and 19/22 (86%) of patients. After interventions, appropriate prophylaxis increased to 117/152 (77%), 36/43 (83%) and 30/33 (90%) of patients in the respective groups. The improvement between baseline and post-intervention rates was 19% (p = 0.0012), 36% (p= 0.0001) and 4% (p=0.5960) (P-values are based on Chi-square with 2 degrees of freedom). Annual audits on VTE prophylaxis are planned to monitor and sustain the success achieved in the project.

A Systematic Review of the Effect of Medication Reconciliation on Medication Discrepancies and Adverse Drug Events

Emily Muir, St. Joseph's Healthcare, Hamilton ON
Christine Wallace, St. Joseph's Healthcare, Hamilton ON

Rationale: Medication Reconciliation (MedRec) is a process that seeks to prevent adverse drug events by reconciling medications at all transition points of care. Accreditation Canada assesses admission medication reconciliation as a performance measure indicator for patient safety. Despite the implementation of MedRec programs in hospitals, little is known about their outcomes.
Objectives: The objective of this systematic review was to determine if the introduction of a formalized medication reconciliation program decreases the number of patients with a medication discrepancy as well as actual or potential discrepancy-related adverse drug events (ADEs)
Study Design and Methods: A search of PubMed (MEDLINE), Embase, IPA, CINAHL, Cochrane, and references of selected articles yielded 241 articles. Five studies which evaluated formalized MedRec programs were found to be suitable for inclusion. Data pertaining to medication discrepancies and the incidence of adverse drug events or potential adverse drug events was extracted.
Results: In the included studies, the percentage of patients with one or more medication discrepancies without a formalized MedRec process ranged from 36.5 to 53 %. With a formalized MedRec program, the percentage of patients with one of more unresolved medication discrepancies was decreased (2.8 to 26.9%). Two studies measured adverse drug events or potential adverse drug events. One study found the incidence of discrepancy- related ADEs to be 14.5%, which decreased to 2.3% once the MedRec program was implemented. A second study rated potential ADEs and found that with the introduction of a MedRec program, only 12.9% of patients (as compared to 29.9% of control patients) had one or more potential ADEs that were likely to cause possible or probable patient discomfort and/or clinical deterioration.
Conclusions: Medication reconciliation decreases the percentage of patients with medication discrepancies and likely decreases the incidence of adverse drug events. More research is needed to assess the clinical outcomes of medication reconciliation programs.

Obtaining the Best Possible Medication History: Comparison of Pharmacy Technician versus Pharmacist Obtained Medication Histories in the Emergency Department

Rochelle Myers[1], Lauza Saulnier[1], Odette Gould[2]
[1]The Moncton Hospital, Zone 1 Moncton, Regional Health Authority B
[2]Mount Allison University

Rationale: Obtaining an accurate and complete medication list (e.g. best possible medication history (BPMH)) is the first step in completing medication reconciliation. The ability of pharmacy technicians to obtain medication histories compared to pharmacists has not been formally assessed.
Objectives: Study objectives were to assess whether pharmacy technicians can perform a BPMH as accurately and completely as pharmacists, and determine if both groups met national norms for unintentional discrepancies and success index for medication reconciliation.
Design and Methods: Patients presenting to the emergency department were prospectively enrolled to be interviewed separately by a pharmacist and a technician, with information recorded on a standard medication reconciliation form. Forms were compared following each set of interviews, and discrepancies were clarified with the patient. Pharmacy technicians were trained in taking BPMH prior to patient enrolment.
Results: Fifty-nine patients were included. Pharmacists and technicians did not differ significantly in whether their patients had prescription (X^2 (1, N=59) = 1.11, p = .29) or OTC (X^2 (1, N = 59) = .15, p = .70) discrepancies. Mean prescription and OTC discrepancies per patient were not significantly different between the two groups (t(58)=.15, p = .88; t(58) = -.22, p = .83). Both groups were significantly lower than the national average for unintentional discrepancies per patient and significantly higher than the national average for success index.
Conclusions: Trained pharmacy technicians can obtain a BPMH with as much accuracy and completeness as pharmacists. Both groups were significantly superior to the national average for unintentional discrepancies and success index for medication reconciliation.

Prevalence of Vitamin D Deficiency and the Effects of Replacement with Ergocalciferol in Chronic Hemodialysis Patients

S Quinton, D Chong, S Donnelly
St Michael's Hospital, Toronto, ON

Rationale: Vitamin D deficiency is common in patients on hemodialysis. Supplementing with ergocalciferol in this population may improve parameters related to anemia, bone mineral metabolism and glucose control.
Objectives: To determine the prevalence of vitamin D deficiency in outpatients on hemodialysis. To assess the effect of ergocalciferol on 25(OH) vitamin D (vitamin D) concentrations and its effect on anemia, bone and glucose related laboratory parameters.
Study Design and Methods: This was a retrospective cohort study in a tertiary university hospital. All patients attending the hemodialysis clinic had vitamin D concentrations obtained and those who were deficient (<75 nmol/L) received ergocalciferol 50,000 units by mouth weekly for 12 weeks followed by 50,000 units monthly. Calcium, albumin, phosphate, intact parathyroid hormone (iPTH), alkaline phosphatase (ALP), hemoglobin A1c, hemoglobin, dose of epoetin alfa or darbepoetin were measured at baseline and 6 months. Paired T test was used in the analysis
Results: Two hundred patients were included in the study. Vitamin D deficiency was identified in 173 patients (86%). One hundred fifty-nine of those patients agreed to take ergocalciferol and 129 had repeat laboratory measurements. Ergocalciferol increased vitamin D concentrations in 104 of 129 patients (81%) to over 75 nmol/L. Significant changes in laboratory parameters and drug dosing are outlined below.

Result	Baseline	6 Months	p
Vitamin D (nmol/L)	32 ± 14.8	99.7 ± 30.9	<0.001
Albumin (g/L)	33.5 ± 3.6	34.6 ± 3.9	<0.001
iPTH (pmol/L)	69.8 ± 80.2	52.5 ±5 6.5	0.005
HgA1c (%)	6.4 ± 1.2	6.6 ± 1.4	0.014
Darbopoetin (µg/wk)	34.6 ± 28.2	29.4 ± 26.7	0.047

No changes were noted in calcium, phosphate, ALP and hemoglobin concentrations or in weekly epoetin alfa dose.
Conclusion: Vitamin D deficiency is prevalent in our population. Ergocalciferol was effective in normalizing vitamin D concentrations and improving some but not all of the relevant laboratory parameters.

Improving the Safety of Ambulatory Intravenous Chemotherapy in Canada

Rachel E. White, University Health Network, Toronto, ON
Venetia Bourrier, CancerCare Manitoba, Winnipeg, MB
Roxanne Dobish, Alberta Health Services, Edmonton, AB
Anthony C. Easty, University Health Network, Toronto, ON

CSHP 2015
This research is linked to the following CSHP 2015 objectives:
- Goal 4: Increase the extent to which pharmacy departments in hospitals and related healthcare settings have a significant role in improving the safety of medication use.
- Goal 5: Increase the extent to which hospitals and related healthcare settings apply technology effectively to improve the safety of medication use.

Rationale: The recent death of a patient due to a fluorouracil overdose, and other similar incidents, have highlighted the risks of ambulatory intravenous (IV) chemotherapy. As a follow-up to root cause analysis (RCA) of the fluorouracil event by the Institute for Safe Medication Practices (ISMP) Canada, this research was funded by a number of cancer and safety agencies across Canada.
Objectives: The objectives of this 20-month study were to identify additional safety issues in ambulatory IV chemotherapy in a wide range of environments across Canada, and to make associated recommendations for safety improvements.
Methods: This study comprised three phases: (1) a national survey of oncology care providers, (2) ethnographic field studies in 6 cancer centres across Canada, and (3) in depth analyses of identified safety issues.
Results: The survey was completed by 331 physicians, pharmacists, nurses and administrators involved in cancer care in all but two provinces and territories. In total, 95.5% of respondents reported they were aware of the fluorouracil incident, and 71% reported they had read the RCA. They also described 213 incidents with ambulatory IV chemotherapy, some of which were very severe. Observations in the field identified 75 unique safety hazards. These were analyzed using a failure modes and effects analysis (FMEA) and assigned hazard scores. Eleven severe issues were identified, and these fell into three categories: (1) elastomeric ambulatory infusion pumps (AIPs) and access devices, (2) chemotherapy orders and labels, and (3) pharmacy admixing practices. Recommendations for improvements in these three areas are currently under development and will be released in early 2010.

Conclusions: Through an interdisciplinary, cross-Canada collaboration, this research has identified a number of unexpected safety hazards in ambulatory IV chemotherapy. Applying mixed research methods such as surveys, ethnographic field studies and in-depth reviews is a useful approach for patient safety research.

Medication Reconciliation Strategies for Transfer (MRS-T): What is the Optimal Strategy?

Cherie Wong[1], Kori Leblanc[1,2], Olavo Fernandes[1,2], Marnie Rodger[1], Susan Chernenko[1], Kelly Lane[1], Tim Tripp[1], Annette Vegas[1], Linda Flockhart[1], Jennifer Harrison[1,2]
[1]University Health Network, [2]Leslie Dan Faculty of Pharmacy – University of Toronto Toronto, ON

Rationale: Poor communication of patient information during internal hospital transfer can lead to medication discrepancies and potential patient harm. Medication reconciliation may decrease these discrepancies.
Description: Our objective was to identify key elements of a strategy for optimal medication reconciliation at internal hospital transfer. Literature review, interviews with local clinicians and national medication reconciliation teams were conducted. Key elements of an ideal internal transfer medication reconciliation strategy were determined. Using the elements and input from a multidisciplinary team, an electronic tool and practice model were designed. A national snapshot of current transfer medication reconciliation practices was also obtained.
Evaluation and Results: Key elements identified and incorporated into our strategy include integration of and accounting for the Best Possible Medication History (BPMH) and pre-transfer medications, sign-off capacity, prescriber intention for all medications readily accessible, clear delineation of ownership while maintaining shared responsibilities among clinicians, a plan for comprehensive sign-over of care of the patient, and standardized training for all disciplines. A key element that could not be incorporated into our model due to technical limitations is the ability to directly link the reconciliation process to the generation of medication orders. Of the Canadian hospitals interviewed (n=16), 69% use a specific tool, 56% incorporate the BPMH, 75% link the process with the ordering of medications and 81% make the prescriber intention available to all clinicians. The top 3 challenges are unclear ownership of tasks, limited resources for collection of the BPMH and clinician education.
Importance: The optimal strategy includes integration of BPMH and pre-transfer medications, delineation of ownership, and use of a tool that incorporates intention for medications and a signoff process. These key elements can be utilized in designing a tool and practice model to facilitate communication with the goal of minimizing medication discrepancies and preventing patient harm at internal transfer.

The "Shock Box" Expediting Delivery of Antibiotics for Septic Shock

Rosemary Zvonar, The Ottawa Hospital, Ottawa ON

Rationale: Multiple studies have demonstrated that timely and appropriate antibiotic administration in patients with severe infection decreases patient mortality. A 7.6% decrease in survival was observed in patients with septic shock with each hour delay in appropriate antimicrobial administration in one landmark study. The time to initial antibiotic dose was the greatest predictor of survival in the multivariate analysis. The "Shock Box" was therefore developed at The Ottawa Hospital in order to expedite delivery of the first antibiotic dose(s) in patients with severe sepsis/septic shock.
Description: The "Shock Box" is an easy to grab box containing the most common antibiotics used in the management of severe infection. It provides ready access to antibiotics for treatment of patients with septic shock 24 hours a day, thus avoiding delays associated with order processing and delivery. The boxes were placed on the Medicine, Hematology-Oncology and Intensive Care (ICU) units and on the RACE (Rapid Assessment of Critical Events) carts. All antibiotics in the box were made available in the Emergency Department (ED).
Evaluation: Between November 1, 2008 and August 15, 2009 the shock boxes were used 122 times, by the following services: Hematology/Oncology (77%), General Medicine (18%), ICU (3%) and other (2%). (Data from the ED was not available.) Fifty-one charts were reviewed in detail. The Shock Box was used appropriately (i.e., for severe sepsis, septic shock, meningitis) in 22/51 (43%) cases. For instances where both the time the antibiotic was ordered and time administered were available, the average time to first dose administration was 0.68 hours (compared to a historic average of 2.72 hours).
Summary: The availability of a "Shock Box" expedites delivery of the initial antibiotic dose for patients with severe sepsis. Ongoing education is required so that use of the box is reserved for its original intention.