CSHP Professional Practice Conference 2020: Poster Abstracts / Conférence sur la pratique professionnelle 2020 de la SCPH : Résumés des affiches

Facilitated Poster Sessions: Discussions of original research and pharmacy practice projects

Séance animée de présentations par affiches : Discussions sur des projets de recherche originale et des projets dans le domaine de la pratique pharmaceutique

Sunday, February 2, 2020 • Dimanche 2 février 2020

Category: Infectious Diseases/Antimicrobial Stewardship

1. Antimicrobial Use Surveillance among Adult Inpatients at Hospitals Participating in a Canadian Sentinel Surveillance Program, 2009–2017
2. Trends in the Antimicrobial Resistance of *Serratia* Isolates Collected from Sunnybrook Health Sciences Centre Inpatients
3. Safety of Administering Cefazolin versus Other Antibiotics in Penicillin Allergic Patients with Anaphylaxis for Surgical Prophylaxis
4. Vancomycin Therapeutic Drug Monitoring in Adult Patients with Methicillin-Resistant *Staphylococcus aureus* Bacteremia and Pneumonia: A Comparison of Trough Concentrations and Area Under the Concentration-Time Curve to Minimum Inhibitory Concentration
5. Evaluating Antimicrobial Use through Point Prevalence Surveys at a Canadian Children's Hospital
6. Resistance Patterns of *Acinetobacter* Isolates Collected over a 14-Year Period at Sunnybrook Health Sciences Centre

Category: Clinical Pharmacy Practice

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2. Pharmacy Clinical and Management Services: A Survey of Small Hospitals in Canada
3. Patients Support a Pharmacist-Led Best Possible Medication Discharge Plan (BPMDP) via Tele-robot in a Remote and Rural Community Hospital
4. Burnout in Hospital Pharmacists: An Ontario-Wide Survey
5. Evaluation of a Pharmacy Department Continuing Education Framework (EDGE)
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Category: Medication Decontamination, Pharmacy Administration, and Pharmacists in Research

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3. Évaluation d'une intervention à trois volets visant à accroître la visibilité de la présence et du rôle du pharmacien
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3. Ceftaroline Monotherapy for the Treatment of Methicillin-Resistant Staphylococcus Aureus Infective Endocarditis: Case Report
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Category: Infectious Diseases/Antimicrobial Stewardship

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4. Assessing the Use of a Standardized Allergy History Questionnaire in Patients with a Reported Penicillin Allergy
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3. Systematic Deprescribing of Proton Pump Inhibitors: Pilot Study in a Geriatric-Medicine Unit at a Community Teaching Hospital
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Category: Medication Safety

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5. Safety IQ: Lessons Learned from a Continuous Quality Improvement Program in Manitoba
6. Intravenous Medication Safety – A Quantitative Analysis of Medication Incidents

Category: Clinical Pharmacy Practice and Drug Stability and Sterility

1. Development, Dissemination and Evaluation of a "Direct Oral Anticoagulant Monitoring Tool" in Family Health Team Pharmacy Practice
2. Optimizing the Management of Heart Failure: Diuretic Therapy at Discharge
3. Roles and Perceptions of Pharmacists as Immunizers of Adult Patients in Tertiary Care Academic Hospitals: An Environmental Scan of Canadian Hospital Pharmacists
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Category: Quality Improvement and Key Performance Indicators

1. Clinical Pharmacy Key Performance Indicators and Pharmacist Job Satisfaction: A Mixed-Methods Study of Canadian Hospital Pharmacists
2. What Clinical Pharmacy Key Performance Indicators (cpKPI) Are Patients Receiving across Canada? A National cpKPI Patient Registry and Pooled Analysis
3. Implementation of Streamlined Electronic Workflow to Capture Key Performance Indicators (KPIs) for Pharmacists
4. Analysis of Pharmacist Clinical Documentation after CST Cerner Transformation
5. Missing Dose Message Audit Using a Closed-Loop Health Information System - A Pharmacy Quality Improvement Project
6. Discrepancies in "As Needed" Medications Prescribed during Hospitalization and at Discharge

The texts of poster abstracts are published exactly as submitted by the authors and have not undergone any copyediting by the Canadian Journal of Hospital Pharmacy. / *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.*

Antimicrobial Use Surveillance among Adult Inpatients at Hospitals Participating in a Canadian Sentinel Surveillance Program, 2009–2017

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Background: The association between antimicrobial use (AMU) and the emergence of antimicrobial resistance is well-documented. Our surveillance program conducts sentinel AMU surveillance at participating hospitals in Canada.

Objectives: Our surveillance program collates AMU from participating hospitals and establishes Canadian benchmarks.

Methods: Participating hospitals submit annual AMU data measured in defined daily doses (DDDs) per the World Health Organization Anatomical Therapeutic Chemical system. Surveillance includes systemic antibacterials (J01s), oral metronidazole (P01AB01), and oral vancomycin (A07AA09). Hospitals also submit patient-day (pd) denominators. Since 2014, hospitals have submitted data by ward-type.

Results: Between 2009 and 2017, 20–26 hospitals participated each year (31 participated ≥1 year; 12 in all years). During this period, overall AMU decreased from 645 to 589 DDD/1000pd (9%). Fluoroquinolones accounted for the majority of this decrease (126 to 72 DDD/1000pd, 43%). The top antimicrobials used in 2017 were cefazolin (88 DDD/1000pd), piperacillin-tazobactam (51 DDD/1000pd), and ceftriaxone (48 DDD/1000pd). Between 2009–11 and 2015–17, the antimicrobials with the largest absolute increases in use were amoxicillin-clavulanate (15 to 28 DDD/1000pd), ceftriaxone (31 to 43 DDD/1000pd), and cefazolin (65 to 76 DDD/1000pd). The antimicrobials with the largest relative increases were fosfomycin (0.0005 to 0.09 DDD/1000pd), daptomycin (1 to 3 DDD/1000pd), and doxycycline (5 to 15 DDD/1000pd). The antimicrobials with the largest absolute decreases in use were ciprofloxacin (74 to 43 DDD/1000pd), metronidazole (42 to 31 DDD/1000pd), and levofloxacin (33 to 24 DDD/1000pd). The antimicrobials with the largest relative decreases were gentamicin (6 to 2 DDD/1000pd), clindamycin (14 to 6 DDD/1000pd), and clarithromycin (7 to 3 DDD/1000pd).

Conclusions: Between 2009 and 2017, there was a 9% decrease in overall AMU at participating hospitals, a 43% decrease in fluoroquinolone use and more moderate increases in use of amoxicillin-clavulanate, ceftriaxone, and cefazolin. AMU surveillance is crucial for establishing Canadian benchmarks and informing stewardship targets.

Trends in the Antimicrobial Resistance of *Serratia* Isolates Collected from Sunnybrook Health Sciences Centre Inpatients

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Background: *Serratia* spp. are opportunistic environmental pathogens that cause a variety of nosocomial infections. These bacteria exhibit intrinsic resistance to many ß-lactam/ß-lactamase inhibitor combinations and early generation cephalosporins. Published data describing longitudinal trends for Serratia resistance rates are scarce. This novel study evaluated resistance patterns of *Serratia* isolates at a large Canadian tertiary care centre.

Objective: To identify changes in antimicrobial resistance patterns of *Serratia* clinical isolates collected at Sunnybrook Health Sciences Center (SHSC) between 2002–2016.

Methods: Susceptibility data for clinical isolates of *Serratia* collected from inpatients at SHSC Bayview campus between October 2002 and September 2016 were extracted from the SHSC Microbiology database. Linear regression was used to evaluate trends in ceftazidime, ceftriaxone, ciprofloxacin, co-trimoxazole, ertapenem, gentamicin, meropenem, piperacillin/tazobactam, and tobramycin resistance at a significance level of 0.05.

Results: A total of 1082 unique *Serratia* clinical isolates were identified. The majority of isolates were obtained from blood (20%), urine (24%), and respiratory (33%) samples. Most isolates were collected from patents admitted to Level 3 ICUs (43%) and greater than 48 hours after admission (72%). *S. marcescens* was the most prevalent species identified (95%); other species included *S.liquefaciens, S.odorifera, S.rubidaea, S.fonticola, S.plymuthica*, and undifferentiated *Serratia* spp. Nineteen percent of isolates exhibited resistance to a therapeutically active antibiotic agent, with 5% of isolates being multidrug resistant. Susceptibility to ceftazidime (~99%), ceftriaxone (~99%), ciprofloxacin (93%),

co-trimoxazole (~99%), ertapenem (~100%), gentamicin (99%), meropenem (~100%), piperacillin/tazobactam (~97%), and tobramycin (~92%) were stable across the 14-year study period.

Conclusion: SHSC *Serratia* clinical isolates exhibited low and stable resistance rates to all antimicrobials assessed over the 14 year study period, with only 5% having multidrug resistance. The continued low risk of antimicrobial resistance with *Serratia spp*. in a setting of an overall global rise in antimicrobial resistance provides some optimism in an otherwise bleak story.

Safety of Administering Cefazolin versus Other Antibiotics in Penicillin Allergic Patients with Anaphylaxis for Surgical Prophylaxis

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Background: Approximately 10% of patients report a history of penicillin allergy. Recent literature suggests cross-reactivity between cephalosporins and penicillins are due to side-chain similarities. Since cefazolin has a unique side-chain from other beta lactams, it can be safely administered in penicillin allergic patients for surgical prophylaxis. Since October 2018, our hospital updated all surgical prophylaxis pre-printed orders to use cefazolin in penicillin allergic patients, except in those with histories of cefazolin-specific allergy or delayed skin reactions (e.g. Stevens-Johnson syndrome).

Objectives: This study aims to retrospectively determine outcomes and safety of cefazolin as compared to other antibiotics for surgical prophylaxis in penicillin allergic patients with anaphylactic histories prior to implementation of cefazolin pre-printed orders.

Methods: All patients with reported anaphylactic reactions to penicillins prescribed surgical prophylaxis from October 9, 2017 to October 9, 2018 were included. Patients were stratified based on antibiotic received (i.e. cefazolin, clindamycin, vancomycin, other antibiotic) and a retrospective chart review was performed to assess for outcomes and safety.

Results: One-thousand-seventy-three prescriptions for prophylactic antibiotics were identified. Of these, 221 cases met inclusion with histories of anaphylaxis to pencillins: 77 (35%) cefazolin, 63 (28%) clindamycin, 33 (15%) vancomycin, and 48 (22%) other antibiotics. General and orthotrauma surgeries used the most cefazolin in penicillin allergic patients, while gynecology the most clindamycin and thoracics the most vancomycin. Amongst those receiving cefazolin, no critical incidents of allergic reactions were reported and the rates of adverse of events did not differ between any antibiotic group.

Conclusion: Cefazolin appears to be a safe option for surgical prophylaxis in patients with history of penicillin anaphylaxis. No differences in incidences of allergic reactions, complications or surgical delays were reported, as compared to alternate antibiotics. Further larger studies are needed to confirm our findings and determine rates of adverse events associated with the various antibiotic regimens.

Vancomycin Therapeutic Drug Monitoring in Adult Patients with Methicillin-Resistant *Staphylococcus aureus* Bacteremia and Pneumonia: A Comparison of Trough Concentrations and Area Under the Concentration-Time Curve to Minimum Inhibitory Concentration

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Background: Vancomycin remains widely used for methicillin-resistant *Staphylococcus aureus* (MRSA) infections, however treatment failure rates up to 50% have been reported. The correlation between vancomycin trough monitoring and efficacy outcomes continues to be controversial. Current evidence supports the use of the 24-hour area under the concentration-time curve to minimum inhibitory concentration (AUC_{24}/MIC) as the pharmacodynamic parameter most likely to predict outcomes in patients with MRSA-associated infections.

Objectives: To determine the discordance rate between trough levels and AUC_{24}/MIC values and how treatment failure and nephrotoxicity outcomes compare between those achieving or missing their pharmacodynamic targets.

Methods: Retrospective cohort study including hospitalized patients with either MRSA bacteremia or pneumonia treated with vancomycin. Trough concentrations were collected and extrapolated minimum concentrations (C_{min}) were calculated. AUC_{24}/MIC values were determined using validated population pharmacokinetic models. Discordance was defined as any instance where a patient's C_{min} corresponded to a C_{min} or AUC_{24}/MIC value falling outside the targets of 15-20 mg/L and 400-700, respectively. Predictors of treatment failure and nephrotoxicity were determined using logistic regression.

Results: 128 patients were included in the analyses. 57% of patients received an initial vancomycin dose < 15 mg/kg. The discordance rate between C_{min} and AUC_{24}/MIC values was 24%. Treatment failure and nephrotoxicity rates were 34% and 18%, respectively. No clinical variables were found to predict discordance. Logistic regression identified vancomycin starting after a positive culture result [OR 4.42 (95% CI 1.36–14.3)] and achieving a target AUC_{24}/MIC after 4 days [OR 3.48 (95% CI 1.39–8.70)] as modifiable predictors of treatment failure.

Conclusions: The relationship between vancomycin monitoring and outcomes is likely confounded by inadequate empiric/initial dosing. Before modifying practice with respect to vancomycin monitoring, focus should be shifted towards optimizing appropriate antibiotic selection and both empiric and weight-based dosing.

Evaluating Antimicrobial Use through Point Prevalence Surveys at a Canadian Children's Hospital

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Background: Establishing an Antimicrobial Stewardship Program (ASP) that includes improving and measuring appropriate antimicrobial use is an Accreditation Canada requirement. Our hospital participated in a Point Prevalence Surveys (PPS) to compare antibiotic use across Canada and evaluate the impact of ASP interventions locally. Current ASP interventions include: prolonged use of broad-spectrum antibiotics, surgical prophylaxis, and beta-lactam allergy (BLA) de-labeling.

Objective(s): To identify the prevalence of patients on empiric broad spectrum antimicrobial therapy (≥4 days), post-operative surgical prophylaxis, and patients reporting a BLA in order to evaluate ASP initiatives.

Methods: Two 1-day, PPS were completed in the Fall (November 2018) and Winter (February 2019) at a tertiary-care pediatric hospital as a part of a larger cross-sectional study which compared antibiotic use over time between 15 Canadian pediatric hospitals.

Results: A total of 576 patients were captured during the PPS with 291 in the Fall and 285 in the Winter. The PPS identified that 252 (44%) patients were taking at least one antimicrobial, which accounted for 462 antimicrobial prescriptions. The majority were intravenous (66%); 23% were enteral, and 11% were topical or inhaled. Six (1.2%) prescriptions beyond day 3 were empiric vancomycin or meropenem. Systemic antibiotics were given more than 24 hours post-operatively as prophylaxis to 13 (6.4%) of 202 eligible patients. Seventeen patients (3%) had documented beta-lactam allergies.

Conclusion(s): Prolonged use of broad spectrum empiric antibiotics and post-operative antibiotics were higher in the fall than winter, but overall rates are low. BLA were present at a rate consistent with previous studies. Current ASP interventions are effective, but continued efforts are necessary to improve and measure the impact.

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/195/showToc

Resistance Patterns of *Acinetobacter* Isolates Collected over a 14-Year Period at Sunnybrook Health Sciences Centre

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Background: *Acinetobacter*'s propensity for multidrug resistance makes it a challenging nosocomial pathogen to treat. Surveillance data from the United States and Europe suggest that *Acinetobacter* bacterial infections carry a crude mortality risk of 30 – 75%, in part as a consequence of inappropriate antibiotic selection; however, data describing patterns of antimicrobial resistance for *Acinetobacter* isolates in Canada are lacking.

Objective: To identify changes in antimicrobial resistance for *Acinetobacter* spp. clinical isolates collected at Sunnybrook Health Sciences Center (SHSC) between 2002 – 2016.

Methods: Susceptibility data for *Acinetobacter* clinical isolates collected from SHSC inpatients between October 2002 to September 2016 were retrospectively extracted from the SHSC Microbiology database. Annual trends in ceftazidime, ceftriaxone, ciprofloxacin, co-trimoxazole, gentamicin, meropenem, piperacillin/tazobactam, and tobramycin resistance rates were analyzed using linear regression with a significance level of 0.05.

Results: Of the 544 *Acinetobacter* isolates identified, 282 (52%) were collected from patients admitted to Level 3 ICUs. Thirty-three percent were collected from respiratory sources, 23% from urine, 19% from blood, and 24% from other sources. Seventeen percent of isolates were multidrug resistant, 7% of isolates were extensively-drug resistant, and one isolate exhibited pan-drug resistance. Resistance of *Acinetobacter* isolates to piperacillin/tazobactam and meropenem increased over time (+2.0% resistant/year, p=0.009; and +1.3% resistant/year, p=0.142, respectively). Conversely, resistance to ciprofloxacin decreased over the study period (-1.4% resistant/year, p=0.086). Resistance rates for ceftazidime, ceftriaxone, co-trimoxazole, gentamicin, and tobramycin remained relatively stable across the 14-year study period.

Conclusion: This study adds to the existing body of literature on *Acinetobacter* resistance and is the first to evaluate trends in the susceptibility of this opportunistic pathogen over an extended period of time in Canada. Given that *Acinetobacter* commonly exhibits multidrug resistance, knowledge of Canadian resistance trends provides valuable guidance in the selection of appropriate empiric antimicrobial agents to treat these infections.

Telepharmacist-Led Warfarin Program: A Prospective Observational Study in Rural and Remote Underserviced Communities

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Background: Warfarin is a high risk medication prescribed to treat and prevent clotting disorders. Monitoring with a blood test ensures safe and effective therapy; if not kept within a narrow range, puts patients at increased risk of harm due to clotting or bleeding. Monitoring, prescribing and follow-up is complex requiring close integration between the patient, pharmacist, lab and physician. Times required to conduct a pharmacist-led warfarin program remotely (dosing, monitoring, patient education and follow-up) are unknown.

Objectives: To describe pharmacist task time requirements in relation to patient encounters, and proportions, administrative and clinical tasks, to conduct a warfarin program.

Methods: This prospective observational cohort study included patients enrolled in the pharmacist warfarin program in 6 remote communities and 1 Family Health Team (FHT) for 11 days over a 3-week period. Pharmacists documented the following time requirements per patient encounter: program software entry (assessment/documentation, dosing, monitoring, patient letter), calls to physician/local health care facility/patients, fax/email/entry into electronic medical record and administrative duties (reports, reminders, faxing prescriptions, program maintenance). Categorical and continuous data described using descriptive statistics and tests for association.

Results: Pharmacists reported 125 patient encounters, with a mean time of 14 minutes per encounter. Documentation of administrative activities occurred 79 times, with a mean duration of 11 minutes. Direct patient care accounted for 60% of program time compared to 40% for administrative duties. FHT represented 33% of program encounters. Mean times to dose/enter in software, gathering patient information, documentation/ letter, calling patient and administrative activities were 3.26, 3.08, 5.07, 2.97, 12.98 minutes respectively.

Conclusions: Data on pharmacist tasks in relation to patient encounters, time requirements and task proportions, both administrative and clinical, to conduct a warfarin program remotely enables both telepharmacy providers and healthcare leadership to make informed decisions on human resources required to conduct a pharmacist-led warfarin program.

Pharmacy Clinical and Management Services: A Survey of Small Hospitals in Canada

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Background: The CSHP Hospital Pharmacy in Canada Report 2016/17 representing180 pharmacy departments across Canada provides quantitative data on pharmacy services clinical and management information in relation to hospital size, type and geographic region for pharmacy and hospital administrators to use in identifying baseline, benchmarking current, and planning enhanced pharmacy services. Unfortunately, for over 300 small hospitals in Canada, this quantitative data remains unknown; hospitals with less than 50 beds remain unrepresented and uninformed.

Objectives: Primary: To collect information and analyze data from small hospitals pharmacy clinical and management services.

Methods: In April 2019, emails to pharmacy administrators of hospitals with less than 50 beds requesting survey participation were sent including the CSHP Hospital in Canada Report and copy of the questionnaire/ link to the survey website. The surveyor followed up with potential respondents and provided reminders and support with survey completion. Study deadline was 30/07/19. Data was downloaded, and results tabulated by the research analyst who prepared summary tables for all the variables captured by the survey.

Results: Twenty-seven eligible hospitals were invited with an 89% completion rate representing 3 provinces and 6 Ontario Local Health Integration Networks. Median hospital size was 19 acute beds (range 0-40), and 4 (range 1-12) programs. Most pharmacies (63%) implement the clinical generalist practice model with limited differentiation of roles. Over half the hospitals reported that pharmacists documented medication reconciliation on admission and 45% on discharge in 76-100% of patients. Data on clinical pharmacy activities and performance, clinical pharmacy key performance indicators, pharmacy department composition, evaluation of clinical services, drug distribution, operation hours, medication administration records and compliance standards were also analyzed.

Conclusions: Data collected from small hospitals provides useful pharmacy clinical and management information to inform hospital administration and pharmacy leaders currently unable to share information on clinical and administrative practices within their institutions.

Patients Support a Pharmacist-Led Best Possible Medication Discharge Plan (BPMDP) via Tele-robot in a Remote and Rural Community Hospital

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Background: Medication reconciliation reduces the risk of preventable medication-related adverse events (ADE); pharmacists have demonstrated they are invaluable in the process. A BPMDP is an accurate list of medications a patient will take when discharged from hospital; home medications stopped, changed and new medications. Despite a publicly funded universal healthcare system, there is inequity in healthcare access; many hospital on-site pharmacists are non-existent. To our knowledge, there are no studies on the extension of a visual presence via a mobile robotic platform with real-time audiovisual communication by pharmacists.

Objectives: Primary: To explore how patients perceive a pharmacist-led real-time BPMDP utilizing a telerobot. Secondary: Describe BPMDP time requirements, unintentional medication discrepancies (MD) and program inefficiencies/barriers and facilitators.

Methods: This prospective cohort pilot study enrolled adult patients admitted to a small community hospital Sept/2017-Feb/2019 who were at high risk of ADE with an anticipated length of stay of 72 hours or greater. Pharmacists created BPMDPs, identified MDs, resolved drug therapy problems (DTP), and interviewed/counselled patients using real-time mobile robotic technology. Thereafter, patients completed an anonymous satisfaction questionnaire. Prescriber discharge MDs (classified by class, type, cause, and intervention), and interview inefficiencies/barriers and facilitators were collected.

Results: Nine patients completed an interview, with a median of 11 medications/patient. Interview agreement rate was 75%, 100% of patients felt comfortable with the robot, and 76% felt care was better. MD rate was 78%, most-frequent MD type, medication omission (71%), class, cardiovascular medication (43%), cause, the medical system (88%), reason, an inaccurate admission medication history (BPMH). Median times for interview preparation, interview, and MD/DTP resolution were 45, 15, and 10 minutes respectively.

Conclusions: Using a telerobot to provide pharmacist-led BPMDPs is acceptable to patients and an innovative, effective solution to identify/ resolve MDs, and support patients and their providers in hospitals that lack in-person access to pharmacists.

Burnout in Hospital Pharmacists: An Ontario-Wide Survey

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Background: Clinician burnout is a work-related syndrome characterized by feelings of emotional exhaustion, depersonalization and reduced personal accomplishment. It is associated with reduced quality of care, medical errors and mental illness. Although extensively studied in Canadian physicians and nurses, there is no previous research to our knowledge assessing burnout in Canadian pharmacists.

Objectives: To determine the prevalence of burnout and its associated risk factors among Ontario hospital pharmacists and explore the current status and interest for preventative programs in undergraduate pharmacy curricula.

Methods: A cross-sectional online survey was conducted of hospital pharmacists recruited through the Canadian Society of Hospital Pharmacists (CSHP) Ontario Branch and hospital e-mail distribution lists. Respondents completed the Maslach Burnout Inventory (MBI) and questions on personal and career characteristics and professional satisfaction. A multivariate regression analysis was used to determine factors independently associated with burnout. All Canadian pharmacy schools were surveyed about their burnout curricula in a separate online questionnaire.

Results: Of 2465 hospital pharmacists in Ontario, 270 responded (11% response rate). The majority of respondents were females (77%) working full-time (90%) in the acute care setting (39%). The burnout rate was 61.1% (95% confidence interval 55.5% to 66.8%). Factors found to be independently associated with burnout were dissatisfaction with work-life balance (OR 2.62, p=0.005) and feeling that contributions were unappreciated (OR 2.60, p=0.019). Of those burned out, based on the

MBI, 23% were not self-aware. Nine of the 10 Canadian pharmacy schools do not currently have burnout prevention curricula; 8 would be interested in incorporating such programs.

Conclusions: The rate of burnout among Ontario hospital pharmacists is high and preventative action is needed. Opportunities to improve pharmacist resiliency and reduce institutional stressors exist at both undergraduate and postgraduate levels.

Evaluation of a Pharmacy Department Continuing Education Framework (EDGE)

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Background: Provision of quality, professional education is complex. Modern and interactive educational practices improve effectiveness of adult learning. Competence in the successful delivery of continuing education may be facilitated with a standardized framework.

Objectives: Develop and pilot a continuing education framework for clinical pharmacists in Saskatchewan Health Authority (SHA) Regina; evaluate learning objectives for alignment with SHA Clinical Practice Standards; evaluate impact of a framework on knowledge transfer and retention in pharmacists with varying experience; and evaluate pharmacist satisfaction with the education framework, as both learners and facilitators.

Methods: This prospective pilot project included development, implementation, and evaluation of an education framework for provision of pharmacist-led education sessions. Development was informed by literature regarding adult learning principles, MainPro+®, CCCEP® Accreditation Standards, and focus group feedback. Pre- and post-session questionnaires based on session-specific learning objectives were completed to determine level of knowledge transfer, and repeated 2 weeks post-session to determine level of knowledge retention. Pre- and post-intervention satisfaction surveys were distributed.

Results: Of 53 eligible pharmacists, 27 (50%) consented to participate. Four education sessions were completed utilizing the framework and 19 participants completed both pre- and post-session questionnaires; the mean knowledge score increased from 57.7% to 84.1% ($p<0.01$), indicating successful knowledge transfer. Of these 19, 16 participants completed both post-session and retention questionnaires with no significant change in mean knowledge score (86.4% to 86.7%, $p=0.96$), suggesting knowledge was maintained 2 weeks post-session. Twenty-six and 17 pharmacists completed the pre-and post-intervention satisfaction surveys respectively. With use of the framework learner satisfaction significantly improved, facilitator confidence increased, and 94% (16/17) agreed that session learning objectives aligned with SHA Regina Clinical Practice Standards.

Conclusion: Implementation of a continuing education framework based on best practices in adult education achieved knowledge transfer and retention, and improved facilitator and learner satisfaction with continuing education.

Evaluating the Quality of Best Possible Medication Histories Performed by Pharmacy Technicians

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Background: Majority of patients admitted into hospitals are classified as having highly preventable adverse drug events (ADEs) causing temporary/permanent disability and extending hospitalization time. Medication reconciliation (MedRec) is known to be a crucial process in preventing ADEs.

Description: Pharmacy technicians have been performing best possible medication history (BPMH) for directly admitted and soon-to-be-admitted patients. In April 2018, a new electronic health record was implemented, and BPMH documentation switched from paper to electronic.

Action: A random, convenient 3-month sample of BPMHs performed between 21Apr-21Jul 2019 were reviewed. Discordance was calculated using deLemos et al method. Inclusion: Patients 18 years and older with prescribed medications, over-the-counter acetylsalicylic acid and non-steroid anti-inflammatory because of the clinically significant roles they have in patients.

Evaluation: MedRec consists of 3 phases: collection, verification and reconciliation. BPMH encompass the first 2 phases. In the paper world, verification was represented by the verification column. In the electronic world, verification is recorded by compliance status. Verification is key to a quality BPMH. Discordance relies on the assumption that patients do not always take medications as dispensed, and a BPMH is likely to detect these differences. We use this as a marker of quality: the more differences, the higher discordance = higher quality BPMH.

$$\frac{\text{number of discordant medications}}{\text{total medications listed in provincial dispensing database and ultimately ordered in hospital}}$$

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/195/showToc

Pharmacy technicians performed the highest quality BPMHs and their quality was similar for paper and electronic documentation.

Implications: Pharmacy technicians gather excellent histories that allow physicians and pharmacist to assess appropriateness and provide continuity of care.

Drug Utilization Evaluation of Chlorothiazide in a Paediatric Quaternary Care Centre

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Background: Chlorothiazide (CTZ), the only intravenous thiazide diuretic available in Canada, has been used at the Hospital for Sick Children since 2011. Prescribing restrictions were implemented due to limited published paediatric evidence and high cost.

Objectives: The primary objectives were to evaluate CTZ usage, cost, and adherence to formulary guidelines.

Methods: This was a single-center, retrospective observational study. Included patients received at least one dose of CTZ between June 2, 2018, and May 31, 2019. Data was collected for dose, duration,

indication, and costs. Usage was considered adherent if other diuretics were optimized. Costs were assessed from all CTZ orders while adherence was assessed from initial orders. Data was analyzed using descriptive statistics.

Results: A total of 181 CTZ orders (with 92 initial orders) were included for 74 patients. CTZ was prescribed in either post-op cardiac patients (59%) or medical (non-post-op cardiac) patients (41%). Adherence to formulary dosing (5 mg/kg/dose q6-12h) was 84.8% with a median (range) duration of 3.5 (1-37) days per course. Non-adherence to guidelines was 64.2% overall. Non-adherence to enteral thiazide criteria was attributed to lack of use (67.4%) or not optimizing enteral thiazide dose (32.6%). Non-adherence to IV loop diuretic criteria was attributed to not optimizing IV loop dose in all cases. The total CTZ cost during the study period was $134,000. The costs of non-adherent initial orders ($43,500) contributed to 68% of the total costs of initial orders ($64,000).

Conclusion: Results indicate that there is room for improvement in maximizing enteral thiazide and IV loop diuretic use and reducing duration of CTZ use. Future studies on de-prescribing and resultant cost savings with improved adherence and optimization of diuretics are needed.

Delirium in the Pediatric Intensive Care Unit: A Nested Case-Control Study

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Background: Delirium is a concerning neurologic dysfunction due to an underlying illness or its treatment.

Objectives: To determine the incidence of delirium and characterize its risk factors and consequences in critically ill children at our pediatric intensive care unit (PICU).

Methods: Retrospective nested case-control study enrolling all children admitted to our PICU for ≥12 hours between September 1, 2017 and August 31, 2018. For each delirious child (Cornell Assessment of Pediatric Delirium score ≥9), we selected an age-matched control.

Results: Forty-four (7%) of the 655 children admitted were screened for delirium. Thirty-nine (89%) of them screened positive, yielding a 6% delirium incidence. Most children (72%) with delirium were ≤5 years old. The median (IQR) onset of delirium was PICU day 7 (4,8), and median (IQR) duration of delirium was 3 (2,5) days. Nine (23%) children received antipsychotic treatment. The severity of illness was not statistically significant different between the case and control groups. Children with delirium were exposed to higher total doses of opioids (median 5 vs 0 mg/kg morphine equivalents), benzodiazepines (median 8 vs 0 mg/kg midazolam equivalents), and dexmedetomidine (median 0 mg/kg in both groups) ($p<0.001$ for all comparisons). The duration of exposure was also longer for opioids (median 5 vs 2 days, $p<0.001$), benzodiazepines (median 8 vs 0 days, $p=0.02$), dexmedetomidine (median 2 vs 0 days, $p<0.001$). Children with delirium had a longer PICU length of stay (median 10 vs 3 days, $p<0.001$), duration of mechanical ventilation (median 6 vs 2 days, $p<0.001$), and more withdrawal (69% vs 8%, $p<0.001$).

Conclusions: The incidence of delirium is 6%, but only a minority of children were screened for delirium. Our PICU has recently increased delirium screening to include more children. Further opportunities to optimize screening and management practices in pediatric delirium should be explored.

Exploration of Sleep Patterns, Sleep Hygiene and the Use of Sleep Aids among University Students

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Background: Sleep is an important component of healthy lifestyles. Worldwide reports suggest that one in every three adults suffers from insomnia. University students are vulnerable to insomnia due to their stressful lifestyle and inconsistent sleeping schedules which contribute to poor sleep hygiene.

Objectives: The purpose of this study is to explore the prevalence of sleeping problems among university students in and to investigate factors contributing to insomnia development.

Methods: A cross-sectional survey utilizing the Pittsburgh Sleep Quality Index (PSQI) and the Sleep Hygiene Index (SHI) questionnaires were administered to a sample of university students in either English or Arabic. An online survey, built using Survey Monkey software, was sent to all the sample university students through e-mail. Descriptive and inferential statistics were used to analyse and report the findings.

Results: A total of 2,062 students responded to this survey. Most of the respondents were females (85%) in their late teens or early twenties (70%). Most respondents were from the colleges of Arts and Sciences, Business and Economics and Engineering (33.3%, 19.3% and 15.7%, respectively). Around 25% of the participating students reported using sleep aids and 15.6% of them used sleep aids within the past month. The PSQI score revealed that around 69.7% of the participants have poor sleep quality (PSQI score >5) and 64% experienced excessive daytime sleepiness. SHI scores for 65.7% of the students were between 14 and 26, indicative of poor sleep hygiene. Also, there was a positive association between the global PSQI score and the SHI scores with a correlation coefficient of 0.391 ($p < 0.0001$).

Conclusion: The findings of this study suggest that poor sleep quality and inadequate sleep hygiene practices are common among this sample of university students, both of which may have a negative impact on students' academic performance, findings that warrants further investigation.

Evaluation of Cardiovascular Risk in Individuals with Serious Mental Illness

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Background: Individuals with serious mental illness (SMI) experience premature death, likely as a result of increased rates of metabolic disorders and major cardiovascular events. Strong evidence indicates that the risk of developing cardiovascular disease (CVD) is higher in people with SMI. Several studies point to inequities in assessing and managing CVD risk in people who experience SMI.

Objectives: The purpose of this study was to estimate the risk for developing CVD in a sample of individuals with SMI attending an outpatient mental health clinic.

Methods: CVD risk was estimated using the World Health Organization/ International Society of Hypertension (WH0/ISH) risk prediction charts for Eastern Mediterranean regions (including Qatar). For those patients with a recorded total cholesterol and high-density-lipoprotein cholesterol (HDL) level, the calculator from the American Heart

Association and the American College of Cardiology (AHA/ACC) was also used. Height and weight were obtained to determine the body mass index (BMI). Data analysis was carried out through SPSS® software.

Results: Of 346 SMI patients included in the cohort, 28% (n=97) had obtainable data to estimate their CVD risk using the AHA/ACC calculator and 32.7% (n=113) using the WHO/ISH CVD risk tables. The cohort had a mean probability of developing CVD or have a major cardiovascular event in the next 10 years of 7.47%, of whom 33% (n=32) were at high risk (AHA/ACC ≥7.5%). When using the WHO/ISH CVD risk tables, significantly lower proportion of patients were estimated to be at high risk (≥20%) and 7.1% (n=8) at moderate risk (10-20%). There was no significant difference in CVD risk among individuals with BMI higher or lower than 30 (p=0.815).

Conclusion: There is high prevalence of CVD risk factors among people with SMI. Adherence to monitoring guidelines and proper documentation of CVD risk in this population is needed.

Impact of Pharmacist-Led Cognitive Behavioural Therapy for Insomnia: A Retrospective Chart Audit

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Background: Cognitive behavioural therapy for insomnia (CBTi) is a first line treatment for insomnia. Several systematic reviews exist describing the significant benefits of CBTi, mostly provided by nurses or psychologists. Unfortunately, wait lists to receive CBTi are long and in some regions the service is not available. Evidence for pharmacists assisting patients with insomnia is minimal. Only one previous study has evaluated pharmacist-led behavioral therapies for insomnia, but it did not include any cognitive interventions.

Objective: The objective of this study was to measure the impact of CBTi, administered by pharmacists, in an ambulatory outpatient clinic setting.

Methods: This study was a retrospective chart audit. Patients were included if they were referred for and completed a CBTi intervention from the pharmacist at one of two outpatient ambulatory care clinics in Saskatoon, Saskatchewan (Canada). Sleep log parameters and insomnia severity index scores were compared at baseline and post CBTi. In addition, data on discontinuation of hypnotic medications were analyzed.

Results: A total of 183 patients were referred for CBTi and 78 completed the intervention. Improvements were observed in the following sleep parameters pre vs. post CBTi: insomnia severity index (18.2 vs. 7.9, p<0.001), sleep onset latency (47.9 minutes vs. 28.0 minutes, p<0.001), wake after sleep onset (60.7 minutes vs. 36.2 minutes, p<0.001), number of awakenings (2.0 vs 1.7, p=0.003), and sleep efficiency (78.2% vs. 86.1%, p<0.001). The proportion of patients using hypnotics was reduced from 71.8% to 52.6% (p<0.001).

Conclusions: This study suggests there is value in CBTi provided by pharmacists in ambulatory clinics. Improvements in sleep indices were both statistically and clinically significant (i.e., insomnia severity index score reduction of ≥ 7 points is considered clinically significant). Randomized trials are needed to confirm the benefit of CBTi when delivered by pharmacists in a variety of practice settings.

The Effect of in Hospital Initiation of Long Acting Injection Antipsychotics on Time to Readmission

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Background: High rates of oral antipsychotic nonadherence in schizophrenia is associated with increased hospitalization risk, relapse, emergency care use, and decreased quality of life. Long acting Injections (LAI) are used to improve adherence. In a meta-analysis of mirror-image studies, LAIs were superior in preventing hospitalizations. We examined the effect of inpatient initiation of LAIs on time to readmission.

Objectives: We compared the time to first readmission after initiation of a LAI antipsychotic, to the time since the last admission while on an oral antipsychotic. The secondary objectives were to determine the effect on mean time between all readmissions, mean total days in hospital and prescribing patterns of LAIs.

Methods: This was a retrospective mirror-image study of patients receiving LAI antipsychotics for the first time from January 1 - December 31, 2015. Data was collected for two years before and after the index admission. The primary outcome was analyzed by Kaplan-Meier plot and log-rank test. Secondary outcomes were analyzed by paired t-tests.

Results: For the primary outcome, mean times to first readmission were 436.5 days and 576.5 days while patients were on oral antipsychotics and LAI antipsychotics, respectively. However, log-rank test of these Kaplan-Meier curves showed no statistically significant difference in the proportion of patients without readmission (Mantel Cox χ^2=3.288, P=0.070). The difference in mean time between all readmissions was 96.9 days (95%CI -8.3-202.1 [P = 0.070]). The difference between the total days in hospital was 10.9 days (95% CI -23.2-1.3 [P = 0.079]). Of the patients initiated on a LAI, 16% had no oral antipsychotic therapy prior to the index admission. LAI antipsychotics were primarily prescribed for schizophrenia.

Conclusion: The results suggest that hospital initiation of LAI antipsychotics could result in longer times to readmission and a decrease in total days in hospital, however statistical significance was not reached.

Évaluation de l'efficacité de stratégies de décontamination pour cinq antinéoplasiques : irinotécan, méthotrexate, gemcitabine, 5-flurouracile et ifosfamide

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Contexte: Des traces d'antinéoplasiques sont présentes sur les surfaces même après nettoyage. Des travaux préliminaires ont permis de déterminer la stratégie à prioriser dans l'entretien des surfaces post-contamination au cyclophosphamide.

Objectifs: Tester une stratégie d'entretien des surfaces post-contamination volontaire par cinq antinéoplasiques : irinotécan, méthotrexate, gemcitabine, 5-fluorouracile et ifosfamide.

Méthodologie: Étude descriptive. Réalisée dans une salle avec une hotte (classe IIB2). Une zone de 600 cm^2 en acier inoxydable du plancher de la hotte a été contaminée concurremment avec 1 ug d'irinotécan (I),

1 ug de méthotrexate (M), 5ug de gemcitabine (G), 10ug de 5-fluorouracile (5FU) et 15 ug d'ifosfamide (IF). Nous avons testé l'efficacité d'une décontamination avec quatre lavages successifs avec ammonium quaternaire; nous avons répété la simulation avec quatre lavages successifs avec hypochlorite de sodium (NACl0) 0,1%. Une dernière simulation avec un lavage avec eau a été également réalisée. Tous les tests ont été faits en triplicata. Les limites de détection étaient respectivement de 0,003ng/cm^2, 0,002ng/cm^2, 0,004ng/cm^2, 0,001ng/cm^2 et de 0,004ng/cm^2.

Résultats: 36 prélèvements ont été réalisés. L'efficacité d'un lavage (eau) variait de 99,5% (M) à 99,79% (IF); l'efficacité d'un lavage (ammonium quaternaire) variait de 99,48% (IF) à 100% (5FU); l'efficacité d'un lavage (NACl0) variait de 99,62% (IF) à 100% (I, M, G, 5FU). L'efficacité d'un 2ème lavage (ammonium quaternaire) était respectivement de 99,82% (M), 99,97% (GEM) et 100% pour les autres. Il faut un quatrième lavage pour éliminer G et des traces persistent encore de M. L'efficacité d'un 2ème lavage (NACl0) variait de 99,96% (G) à 100% (I, IF, M, 5FU).

Conclusion: Il est possible de décontaminer les surfaces contaminées avec irinotécan, méthotrexate, gemcitabine, 5-fluorouracile et ifosfamide avec un ammonium quaternaire, de l'hypochlorite de sodium et de l'eau. Toutefois, plus d'un nettoyage peut être nécessaire pour éliminer toute trace détectable.

Évaluation de l'acte pharmaceutique : une enquête auprès des chefs de départements de pharmacie du Québec

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Contexte: Afin d'assurer une prestation sécuritaire des services et soins pharmaceutiques et pour répondre aux exigences du Code de déontologie des pharmaciens, il est nécessaire d'évaluer la pratique pharmaceutique.

Objectif: Décrire les pratiques entourant l'évaluation de l'acte pharmaceutique en établissement de santé au Québec.

Méthodologie : Étude descriptive transversale auprès de tous les chefs de départements de pharmacie du Québec. Questionnaire en ligne comportant 23 variables. Une échelle de Likert à quatre choix (TA=très en accord, PA=partiellement en accord, PD= partiellement en désaccord, TD=totalement en désaccord) a été utilisée pour les variables de perception. Le questionnaire en ligne (SurveyMonkey, Palo Alto, CA, ÉUA) a été prétesté et partagé par courriel du 23 au 30-3-2019. Un seul rappel a été expédié par courriel. Seules des statistiques descriptives ont été effectuées.

Résultats: Vingt-cinq chefs de département ont répondu à l'enquête (taux de participation de 83%). L'enquête révèle la présence d'un comité d'évaluation de l'acte pharmaceutique dans 40% (10/25) des départements de pharmacie. Les méthodes d'évaluation par rapportées par les répondants comprennent la tenue de revue par critères explicites (89%, 8/9), l'évaluation d'indicateurs (56%, 5/9) la revue de dossiers patients spécifiques (33%, 3/9) et critères implicites (33%, 3/9). Parmi les centres n'ayant pas encore de comité d'évaluation de l'acte pharmaceutique, neuf envisagent la mise en place d'un tel comité d'ici 24 mois.

Conclusions: Les chefs de départements de pharmacie déclarent la présence d'un comité d'évaluation de l'acte pharmaceutique dans 10 départements de pharmacie au Québec. De plus, neuf répondants prévoient la mise en place d'un tel comité dans les 24 prochains mois. L'enquête met également en évidence les pratiques et perceptions des chefs de départements de pharmacie en ce qui concerne l'acte pharmaceutique. Il n'existe pas de consensus quant aux comités appropriés de discussion pour des événements en lien avec la pratique pharmaceutique.

Évaluation d'une intervention à trois volets visant à accroître la visibilité de la présence et du rôle du pharmacien

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Contexte: On retrouve des pharmaciens dans la plupart des programmes de soins hospitaliers à l'échelle du Canada. Toutefois, on dispose de peu de données sur la visibilité associée à cette présence.

Objectifs : Décrire et évaluer la faisabilité d'implanter une intervention à trois volets visant à accroître la visibilité du pharmacien et de son rôle dans l'équipe traitante, pour permettre d'optimiser les soins pharmaceutiques. Comparer la perception et la satisfaction des parents et des soignants exposés à des soins pharmaceutiques usuels et des soins pharmaceutiques intégrant l'intervention.

Méthodologie : Étude expérimentale randomisée-contrôlée à simple aveugle au CHU Sainte-Justine chez des patients admis dans les unités de pédiatrie entre le 5-3-2019 et le 8-8-2019. Les soins pharmaceutiques usuels incluent: revue quotidienne de dossier, participation à la tournée médicale, rencontre avec les patients et intervention si requis. En sus des soins usuels, l'intervention inclut: remise d'une brochure d'information sur les services et soins pharmaceutiques, accès à une ligne téléphonique d'assistance et complétion par le pharmacien d'un formulaire de congé standardisé.

Résultats : 641 participants ont été inclus dans l'étude (321 intervention c. 320 témoin). La brochure a été remise à tous les parents du groupe intervention. Douze appels téléphoniques ont été placés via la ligne téléphonique d'assistance. Le formulaire de congé standardisé a été complété pour 46,7% (150/321) des participants du groupe intervention. Une majorité des répondants (81,2%, 298/367) se disent satisfaits des services et soins pharmaceutiques reçus dans les deux groupes.

Conclusion: Il a été faisable d'implanter les trois volets de l'intervention sur une période de six mois. Cette intervention est perçue comme étant positive par les parents et les soignants exposés, et la majorité des répondants ont été satisfaits des services et soins pharmaceutiques offerts.

Environmental Contamination with Nine Antineoplastic Drugs in 93 Canadian Centers

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Background: Antineoplastic drugs traces are measured on many surfaces in healthcare centers. A biannual surveillance of antineoplastic traces is recommended in Canadian guidelines.

Objectives: To monitor environmental contamination by nine antineoplastic drugs in Canadian centers. To explore the impact of factors that may be associated with surface contamination.

Methods: Twelve standardized sites were sampled in each participating center after a working day, before any cleaning was performed (six in the oncology pharmacy and six in patient care areas). Each sample was prepared to allow quantification of six antineoplastic drugs (cyclophosphamide, ifosfamide, methotrexate, gemcitabine, 5-fluorouracil, irinotecan) by ultra-performance liquid chromatography-tandem mass spectrometry. Three additional antineoplastic drugs were detected, but not quantified (docetaxel, paclitaxel, vinorelbine). The impact of some factors was evaluated with a Kolmogorov-Smirnov test for independent samples.

Results: Ninety-three Canadian centers participated in 2019 with 1045 surfaces sampled, 551 in pharmacy and 494 in patient care areas. Cyclophosphamide was most often measured on surfaces (32.4% positive samples, 75th percentile=0.0017 ng/cm², 90th percentile=0.021 ng/cm²) followed by gemcitabine (20.3% positive samples, 75th percentile<limit of detection (LOD), 90th percentile=0,0059 ng/cm²) and 5-FU (8.5% positive samples, 75th and 90th percentile<LOD). The front grille inside the hood (81.5% of samples positive for at least one antineoplastic drug), the arm rest (75.8%), the floor in front of the hood (65.2%) and the storage shelf (55.4%) were more frequently contaminated. Traces of all antineoplastics but one (docetaxel) were detected. Centers with a higher number of oncology inpatient and outpatient beds, who prepared more antineoplastic drugs per year and used more cyclophosphamide per year had higher concentrations of cyclophosphamide on their surfaces ($p<0.0001$).

Conclusions: Some working surfaces were frequently contaminated despite the implementation of safe handling guidelines. The use of personal protective equipment remains essential. Environmental monitoring can help centers to monitor their practices and identify contaminated areas.

Environmental Scan of Hospital Pharmacist Participation in Research in Canada

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Background: There is interest and need to encourage Canadian pharmacists to conduct hospital pharmacist-driven research activities (HPDRA), but barriers and opportunities need to be assessed.

Objective(s): Describe hospital pharmacists' participation in research, existing models of pharmacy research units (PRU) and funding opportunities for HPDRA in Canada.

Methods: A bilingual cross-sectional validated survey (Survey Monkey™) was e-mailed to pharmacy directors of Canadian hospitals with ≥ 200 acute care adult or pediatric beds. Participants were given 4 weeks to complete anonymously the 38 question survey and 3 reminders were sent. The research ethics board approved the study. Descriptive statistics are presented.

Results: The survey response rate was 40% (42/104). Sixty percent of respondents were from academic teaching hospitals. The median number of pharmacists per hospital was 43. Sixty-four percent (n=27) of hospitals had pharmacists participating in HPDRA. Only these were asked to respond to the full survey. Amongst these hospitals, the median number of research projects conducted was 9.0 (IQR: 2.5-18.8) over the last 2 years. Approximately half were pharmacy residency projects. The most common types of projects were pharmacy practice, retrospective, drug utilization and prospective cohort or observational studies. The majority of departments published at least 1 manuscript in peer-reviewed journals in the last year, with 25% publishing > 10. The key barriers identified by the directors of pharmacy were lack of dedicated time, research grants, research training and resources. Sixty-five percent of hospitals had some pharmacists with dedicated time for research. Only 5 hospitals had a PRU. The median annual research budget was 17 500$ (IQR: 0 – 76 250$) and the main source of funding was the general pharmacy budget.

Conclusion(s): HPDRA across Canada are modest due to important barriers and limited budgets. Few hospital pharmacy departments have developed a PRU offering resources to facilitate research.

Pharmacists' Experience, Motivation, Attitudes, Self-Perceived Competence and Training Needs to Conduct Pharmacist-Driven Research in a Tertiary Care Teaching Hospital

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Background: Pharmacists in our institution are encouraged to conduct research activities.

Objective(s): Describe hospital pharmacists' research experience as principal or co-investigator in the last 5 years, and their motivation, attitudes, barriers, facilitators, self-perceived competence and training needs regarding research.

Methods: A bilingual validated cross-sectional survey (Survey Monkey™) was e-mailed to all pharmacists employed at a tertiary care teaching hospital. Participants were given 4 weeks to complete anonymously the 41 question survey and 3 reminders were sent. The study was approved by the research ethics board. Descriptive statistics are presented.

Results: The survey response rate was 58% (60/104). The median pharmacist work experience was 9.0 (IQR: 4.0-20.8) years. In the last 5 years, 63% had participated in research activities. Of these and over this period, 69% had published at least one research manuscript and only 5 had received research funding (median 0$; range 0-15 000$) as principal investigator. The median devoted research time was 5 hours (IQR 0-80) per month and the most common types of study designs were descriptive and observational. Most pharmacists (86%) would like greater involvement in research activities and 76% agree that participation in research activities is important to the pharmacy administration. The most common barriers identified by respondents were lack of time, large clinical workload and insufficient staff / resources while potential facilitators included dedicated time in schedule, hiring research resources and pharmacy research mentorship. Pharmacists rated themselves as not very (35%) or moderately (60%) competent to conduct research. Significant training needs identified are statistics, preparation of a grant application and coordinating studies.

Conclusion(s): Our pharmacists are highly motivated to conduct research but require dedicated time, research resources and additional training in statistics and methodology, as well as support in grant application and study coordination.

Disseminated Intravascular Coagulation and Autoimmune Hemolytic Anemia with Oxaliplatin Treatment for Metastatic Colon Adenocarcinoma: A Case Report

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Background: Oxaliplatin is a platinum alkylating chemotherapeutic agent commonly used in the treatment of colorectal cancer. In rare cases, disseminated intravascular coagulation (DIC) and autoimmune hemolytic anemia (AIHA) have been reported with oxaliplatin use. DIC is characterized by the intravascular activation of coagulation, causing microvascular damage to end organs, often overwhelming the coagulation cascade leading to bleeds. AIHA is the autoimmune-mediated destruction of red blood cells (RBCs) by antibodies. Management of both conditions relies on limited evidence from clinical trials in combination with clinical experience.

Case Description: This case describes a 53 year old female undergoing treatment with capecitabine, oxaliplatin, and bevacizumab for adenocarcinoma of the colon. Immediately post-oxaliplatin infusion the patient experienced large volume emesis and a vasovagal episode. Laboratory findings were suggestive of a new coagulopathy and anemia. The patient was diagnosed with AIHA and DIC, and was successfully treated with high dose steroids, transfusions, as well as temporary hemodialysis.

Assessment of Causality: It is probable in this case that DIC and AIHA could be secondary to oxaliplatin, as these adverse events occurred after administration, and resolved after discontinuation. The Naranjo Scale gives DIC four points and AIHA seven points, making these reactions possible and probable, respectively.

Literature Review: Only 1 case report was found that included both DIC and AIHA related to oxaliplatin. Two case reports were identified describing DIC related to oxaliplatin in patients with metastatic colon adenocarcinomas, and 5 case reports were identified for AIHA alone. The Health Canada Adverse Event Reporting Database contained 4 reports of oxaliplatin associated AIHA.

Importance to Practitioners: Oxaliplatin is commonly used for the treatment of colorectal adenocarcinomas and other malignancies. Practitioners should be aware of rare adverse events associated with oxaliplatin such as DIC and AIHA, in order to provide timely treatment and prevent significant morbidity and mortality.

Impact of Ultrafiltration on Tobramycin Clearance and Dosing

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Background: Treatment of serious Gram negative infections with aminoglycosides requires achieving strict peak and trough concentrations to optimize efficacy while reducing risk of adverse effects. Dosing to maintain these targets in patients on hemodialysis and ultrafiltration can be challenging as aminoglycoside clearance is highly variable and depends on dialysis type, filter used and duration. Ultrafiltration (UF) is the process by which water is removed. This is done by means of solute movement across a semipermeable membrane from the area of higher concentration (blood) to lower concentration (ultrafiltrate).

Case description: Nineteen year-old female with complex medical history significant for CNS hemophagocytic lymphohistiocytosis (HLH) and CKD secondary to prior immunosuppressant therapy on intermittent hemodialysis. Tracheal aspirate cultures positive for multi-drug resistant *Pseudomonas aeruginosa* sensitive to gentamicin and tobramycin. During the course of tobramycin therapy, patient required a session of UF. Drug level evaluation was undertaken to appreciate the impact of UF on tobramycin clearance and whether an additional post-UF dose would be required.

Assessment of causality: Patient received usual hemodialysis session on August 30th after which a dose of tobramycin 90mg was administered intravenously. Peak serum concentration was measured to be 7.97 mg/L (target 8-10 mg/L). On August 31st, a 2 hour UF session was performed. Tobramycin serum levels were collected in the morning prior to UF and again that evening after UF. Pre-UF level was 5.31 mg/L and post-UF level was 3.65 mg/L. As the post-UF level was greater than the usual trough target of <1 mg/L, an additional tobramycin dose was not ordered.

Literature review: There is a paucity of current literature detailing the rate of tobramycin by UF specifically.

Importance to Practitioners: A single session of UF in this patient did not alter tobramycin clearance in such a way that additional dosing was needed.

Ceftaroline Monotherapy for the Treatment of Methicillin-Resistant Staphylococcus Aureus Infective Endocarditis: Case Report

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Background: Ceftaroline is a 5th generation cephalosporin with broad spectrum activity against gram positive and negative bacteria including Methicillin-Resistant Staphylococcus aureus (MRSA). It is indicated for complicated skin and soft tissue infections and community-acquired pneumonia. Case-reports have shown clinical success treating bacteremia and endocarditis caused by MRSA when combined with daptomycin. This case report describes a case of MRSA bacteremia and infective endocarditis treated with ceftaroline monotherapy.

Case Description: A 51 year old male presented to hospital with MRSA bacteremia secondary to a diabetic foot ulcer. He was initially treated with vancomycin which was changed to daptomycin after developing acute on chronic renal failure. He was discharged on daptomycin therapy and re-presented to hospital 2 weeks later with MRSA positive blood cultures. He declined clinically with recurrent fevers and positive blood cultures reporting increased resistance to daptomycin. Transesophageal echocardiogram confirmed implantable cardioverter defibrillator (ICD) infective endocarditis. Ceftobiprole was added to the daptomycin regimen, but blood cultures remained positive. The ICD was extracted, ceftobiprole was changed after 4 days of therapy to ceftaroline due to concerns of possible MRSA resistance, and daptomycin was discontinued due to elevated creatinine kinase. Subsequent cultures returned negative. He clinically improved and continued 6 weeks of ceftaroline monotherapy.

Assessment of Causality: Blood cultures drawn during ceftobiprole therapy remained positive. After treatment was changed to ceftaroline and the ICD was removed cultures returned negative and microbiological cure was achieved.

Literature Review: An *in vitro* study showed ceftaroline was more potent than ceftobiprole against MRSA. A 1-year surveillance study in Italy described an MRSA ceftobiprole resistance rate of 12%. One published

case series reported clinical success with ceftaroline monotherapy as salvage therapy for MRSA bacteremia and endocarditis.

Importance to Practitioners: Ceftaroline monotherapy is a treatment alternative for MRSA infective endocarditis, where vancomycin and daptomycin cannot be used.

Description des activités réservées de la Loi 41 réalisées par les pharmaciens dans un hôpital universitaire

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Contexte : La loi 41 permet d'élargir le rôle et l'autonomie du pharmacien. Peu de données objectives sont publiées quant à son application en établissements de santé et son application n'est pas encore très répandu dans la pratique.

Objectifs : Décrire les activités réservées de la Loi 41 réalisées par les pharmaciens dans centre hospitalier universitaire. Décrire l'impact clinique des actes de la Loi 41 (majeur, significatif, mineur, non déterminé).

Méthodologie : Étude rétrospective recensant les neuf activités réservées de la Loi 41 sur une période de 13 jours, du 5 au 21 décembre 2018. Les actes réalisés étaient identifiés à partir des rapports des pharmaciens œuvrant dans les secteurs cliniques. Le dossier patient électronique et le dossier pharmacologique informatisé ont été utilisés pour réaliser la collecte de données. L'analyse statistique était de nature descriptive. L'impact clinique des activités a été déterminée à partir d'une échelle connue. L'étude a été approuvée par le comité d'éthique.

Résultats : Parmi les 1291 patients ciblés, 172 ont eu au moins un acte réalisé pour un total de 336 actes documentés. Les principales activités réalisées ont été la prescription d'une analyse de laboratoire (29,2%;n=98), la prolongation d'une ordonnance (23,5%;n=79), la modification de la dose afin d'assurer la sécurité (20,0%;n=67) et la modification de la posologie (12,2%;n=41). L'impact clinique a été évalué comme étant majeur (14,6%;n=49), significatif (72,3%;=243) et mineur (12,8%;n=43).

Conclusion : Les pharmaciens réalisent quotidiennement les activités réservées de la Loi 41 dans le centre hospitalier universitaire. Trois types d'actes de la Loi 41 comptent pour 73% des activités réalisées. L'impact clinique est majoritairement significatif pour les actes réalisés. Les données colligées confirment l'élargissement du rôle du pharmacien en établissement de santé.

Terbinafine Induced Thrombotic Thrombocytopenic Purpura

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Background: Thrombotic Thrombocytopenic Purpura (TTP) is a medical emergency that is almost always fatal if not properly treated. It presents as thrombocytopenia, microangiopathic hemolytic anemia, and often signs of end-organ damage. It is caused by autoantibodies directed at ADAMTS13, a von Willebrand factor-cleaving protease, resulting in small-vessel platelet-rich thrombi. Autoantibody production can be hereditary, or acquired from certain disease states or medications.

Case Description: A 78 year-old woman presented with a 5-day history of increasing malaise, fatigue, and altered mentation. Her laboratory results were consistent with hemolysis in addition to profound thrombocytopenia, which was suspicious for TTP. The ADAMTS13 activity level was less than 1% and ADAMTS13 inhibitor level was greater than 94 U/mL. ADAMTS13 inhibitor values above 15 U/mL in the context of ADAMTS13 activity values below 10% are diagnostic of TTP. The patient was initiated on daily plasma exchange and prednisone. The patient's only medication on admission was oral terbinafine, which was started 4 weeks prior to admission. It was felt that TTP was likely induced by terbinafine, which was therefore discontinued. The patient responded well to therapy and was discharged home 11 days later.

Assessment of Causality: The Naranjo score for this adverse drug reaction is 7, indicating that TTP was probably caused by terbinafine.

Literature Review: Three cases of oral terbinafine induced TTP were submitted to the Health Canada Reporting Database in the 1990s. Only 1 published case report was found in the literature. However, the drug product monograph was updated in January 2017 to include TTP as a possible ADR after some reported cases.

Importance to Practitioners: TTP is associated with a high mortality. Therefore, it is important for practitioners to promptly recognize this rare drug-induced reaction, discontinue the medication and provide treatment. With proper management, survival rates up to 90% are possible.

Gemcitabine-Associated Atypical Hemolytic-Uremic Syndrome Treated with Eculizumab

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Background: Atypical Hemolytic-Uremic Syndrome (aHUS) is a potentially life-threatening thrombotic microangiopathy (TMA) characterized by anemia, thrombocytopenia, and renal failure. It can be drug-induced and is caused by uncontrolled activation of the complement system. Management of drug-induced aHUS usually involves plasmapheresis. Eculizumab, a monoclonal antibody that inhibits the complement cascade, has also been used. This case report details the successful management of gemcitabine-induced aHUS treated with eculizumab.

Case Description: A 41-year-old female with hepatic cholangiocarcinoma was started on a regimen of cisplatin and gemcitabine. Eight months into the regimen, the treatment was stopped due to a splenic infarct, significant vision changes, new onset hypertension, thrombocytopenia, elevated lactate dehydrogenase (LDH), and serum creatinine peaking at 375 umol/L. Plasmapheresis was started with minimal effect. On day 9, eculizumab was started and her platelet count, LDH and renal function significantly improved. She received 3 months of treatment with eculizumab at which time it was stopped.

Assessment of Causality: This case of aHUS would receive a score of 4 on the Naranjo Scale indicating a possible association with gemcitabine.

Literature Review: Gemcitabine-associated aHUS has been documented in 107 cases, with approximately 15% classifying it to be a definite or probable cause. It has a reported incidence of 0.02-2.2% and a mortality rate of up to 60%. There is no high-quality evidence showing benefit of plasmapheresis for aHUS. Eculizumab has been shown to improve renal function, platelet count, and hemolysis in observational studies.

Importance to Practitioners: Gemcitabine is commonly used to treat solid tumor cancers. Albeit rare, Gemcitabine-associated aHUS can lead

to significant morbidity and mortality if left untreated. Timely diagnosis and treatment are crucial to minimize complications such as end stage renal disease and death. Early initiation of eculizumab may be beneficial as plasmapheresis has been shown to be minimally effective in these cases.

Stability of Morphine Solutions of 20mcg/mL, 40mcg/mL 100mcg/mL 200mcg/mL, 1,000mcg/mL in Syringes Following Dilution with 0.9% Sodium Chloride at Room Temperature (25°C)

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Background: Paediatric patients require lower concentrations of continuous infusions than adults and while previous publications have demonstrated the stability of morphine, data for lower concentrations stored in syringes for more than 14 days is not available.

Objective: To evaluate the chemical stability morphine prepared in syringes at 5 concentrations following dilution in saline and stored in syringes at room temperature.

Methods: On study day 0, 3 units of each of 5 concentrations were prepared and stored at room temperature. Concentration and physical inspection were completed on study days 0, 2, 7, 14, 21, 28,42,56,72, and 91. Morphine concentrations were determined by a validated stability-indicating liquid chromatographic method with UV detection. The maximum chemical stability was determined based on the intersection of the lower limit of the 95% confidence interval of the observed degradation rate and the time to achieve 90% of the initial concentration.

Results: The analytical method separated degradation products from morphine such that the concentration was measured specifically, accurately (deviations from known averaged 2.17%) and reproducibly (replicate error within a day averaged 0.45% and between days averaged 1.09%). A second estimate of between-days reproducibility, the standard deviation of regression averaged 0.64%. During the study period all solutions retained more than 98.42% of the initial concentration in vials and syringes at both temperatures and concentrations. Multiple linear regression (capable of detecting differences of 0.54%) revealed significant differences in percent remaining due to study day (p=0.013) and concentration (p=0.001). The calculated maximum stability exceeded the 91-day study period for all concentrations.

Conclusions: We conclude that morphine concentrations between 20mcg/mL and 1,000mcg/mL are physically and chemically stable for at least 91 days at room temperature (25°C) in syringes. When establishing a BUD, both the stability of the components and the sterility limits established by NAPRA/USP 797 must be considered.

Stability of a New Generic Formulation of Bortezomib Injection (Apotex Brand) in Vials and Syringes Stored at 4°C and Room Temperature (25°C)

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Background: New generic versions of bortezomib raise questions about the reliability of extending stability study data between brands.

Objective: To evaluate the stability of Apotex-bortezomib formulation reconstituted with 0.9% sodium chloride (NS) to produce concentrations of either 1.0 or 2.5mg/L during storage over 42 days at room temperature (25°C) and at 4°C in syringes and manufacturer vials.

Methods: On study day 0, 1.0 and 2.5mg/mL concentrations of the Apotex formulation were prepared. Three units of each container were stored at 25°C and three were stored at 4°C. Concentration and physical inspection were completed on study days 0,1,4,8,11,15,18,21,28,35 and 42. Bortezomib concentrations were determined by a validated stability indicating liquid chromatographic method with UV detection. The recommended beyond use date (BUD) was determined based on the intersection of the lower limit of the 95% confidence interval of the observed degradation rate and the time to achieve 90% of the initial concentration.

Results: The analytical method separated degradation products from bortezomib such that the concentration was measured specifically, accurately (deviations from known averaged 2.17%) and reproducibly (replicate error averaged 0.44% within-days and 2.19% between-days). A second estimate of between-days reproducibility, the standard deviation of regression of study samples, average 1.06%. Multiple linear regression revealed significant differences in percent remaining due to study day (p<0.001) and temperature (p=0.001), but not container (p=0.117) or concentration (p=0.223). Apotex-bortezomib retained >90% of its initial concentration for the duration of the 21-day period for all temperatures, containers, and concentrations.

Conclusions: Apotex-bortezomib formulation reconstituted with NS to concentrations of 1.0 and 2.5mg/mL are physically and chemically stable for at least 42 days at 25°C or 4°C in both syringes and the original manufacturer's glass vials. When establishing a BUD, both the stability of the components and the sterility limits established by NAPRA/USP 797 must be considered.

Stability of a New Generic Formulation of Bortezomib Injection (MDA Brand) in Vials and Syringes Stored at 4°C and Room Temperature (25°C)

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Background: New generic versions of bortezomib raise questions about the reliability of extending stability study data between brands.

Objective: To evaluate the stability of MDA-bortezomib formulation reconstituted with 0.9% sodium chloride (NS) to produce concentrations of either 1.0 or 2.5mg/L during storage over 21 days at room temperature (25°C) and at 4°C in syringes and manufacturer vials.

Methods: On study day 0, 1.0 and 2.5mg/mL concentrations of the MDA formulation were prepared. Three units of each container were stored at 25°C and three were stored at 4°C. Concentrations were determined and physical inspections were completed on study days 0,1,2,5,7,11,14,18 and 21. Bortezomib concentrations were measured by a validated stability -indicating liquid chromatographic method with UV detection. The maximum chemical stability was determined based on the intersection of the lower limit of the 95% confidence interval of the observed degradation rate and the time to achieve 90% of the initial concentration.

Results: The analytical method separated degradation products from bortezomib such that the concentration was measured specifically,

accurately (deviations from known averaged <2%) and reproducibly (replicate error averaged <1% within-days and <2% between-days). A second estimate of between-days reproducibility, the standard deviation of regression of study samples, averaged 1.0%. Multiple linear regression revealed significant differences in percent remaining due to study day ($p<0.001$) and temperature ($p<0.001$), but not container ($p>0.02$) or concentration ($p>0.2$). MDA-bortezomib retained >90% of its initial concentration for the duration of the 21-day period for all temperatures, containers, and concentrations.

Conclusions: MDA-bortezomib formulation reconstituted with NS to concentrations of 1.0 and 2.5mg/mL are physically and chemically stable for at least 21 days at 25°C or 4°C in both syringes and the original manufacturer's glass vials. When establishing a BUD, both the stability of the components and the sterility limits established by NAPRA/USP 797 must be considered.

Stability of 3.33 mg/mL Bicalutamide in Syringes and Amber Plastic Bottles Following Reconstitution with Sterile Water or Oral Mix Sugar Free at 4°C and Room Temperature (25°C)

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Background: A commercial bicalutamide suspension is not available in Canada and the stability of an extemporaneous formulation has not been previously reported.

Objective: To evaluate the stability of 3.33mg/mL bicalutamide prepared in sterile water (SW) or suspended in Oral Mix Sugar Free – Medisca (OMSF) during storage over 90 days at room temperature (25°C) or refrigerated (4°C) in plastic syringes and amber plastic bottles.

Methods: On study day 0, bicalutamide (Accord) 3.33mg/mL suspensions were prepared. Three units of each container were stored at room temperature and 3 were stored in the refrigerator. Concentration and physical inspection were completed on study days 0,2,7,14,21,28,42,56,72, and 90. Bicalutamide concentrations were determined by a validated stability-indicating liquid chromatographic method with UV detection. The maximum chemical stability was determined based on the intersection of the lower limit of the 95% confidence interval of the observed degradation rate and the time to achieve 90% of the initial concentration.

Results: The analytic method separated degradation products from bicalutamide such that the concentration was measured specifically, accurately (deviations from known averaged 2.02%) and reproducibly (replicate error within-a-day averaged 0.35% and between-days averaged 0.98%). A second estimate of between-day reproducibility, the standard deviation of regression of study samples, averaged 1.10%. Multiple linear regression did not identify any significant differences in percent remaining to container ($p=0.06$), diluent ($p=0.37$), temperature ($p=0.46$), or study date ($p=0.96$). The study was capable of detecting a 0.99% difference in concentration due to study day, temperature, container, or diluent. The bicalutamide suspension retained >90% of its initial concentration for the 90-day period for all temperatures, diluents and containers.

Conclusion: We conclude that a 3.33mg/mL bicalutamide suspension prepared with SW or OMSF is physically and chemically stable for at least 90 days at 4°C or 25°C in plastic syringes or amber plastic bottles.

Chemical Stability of Epinephrine Diluted in 0.9% Sodium Chloride and Stored in Polypropylene (PP) Syringes at 4°C and 25°C

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Background: A previous publication has demonstrated the stability of 25, 50 and 100 mcg/mL epinephrine solutions for 30 days, but not concentrations as low as 10 mcg/mL.

Objective: To evaluate the chemical stability epinephrine prepared in syringes at concentrations of 10 mcg/mL diluted in 0.9% sodium chloride (NS) at both room temperature (25°C) and under refrigeration.

Methods: On study day 0, 10mL solutions of 10 mcg/mL epinephrine diluted in NS were prepared and stored in BD syringes. 3 units of each container and concentration were stored at room temperature and 3 were stored at 4°C. Concentration analysis was completed on study days 0,2,7,14,21,28,42,56,72 and 91 using a validated stability-indicating liquid chromatographic method with UV detection. Chemical stability was based on the intersection of the lower limit of the 95% confidence interval of the observed degradation rate and the time to achieve 90% of the initial concentration (T-90).

Results: The analytical method separated degradation products from epinephrine such that the concentration was measured specifically, accurately (deviations from known averaged 2.13%) and reproducibly (within-day replicate error averaged 0.48%(CV(%)). During the study period all solutions at 4°C retained more than 89.62% of the initial concentration for 91 days. Solutions stored at 25°C retained more than 90% for 21 days. Multiple linear regression revealed significant differences in percent remaining due to study day ($p=0.00002$) and temperature ($p=0.00186$). The calculated T-90, with 95% confidence, was 71.40 days for solutions stored at 4°C but only 12.77 days for solutions stored at 25°C.

Conclusions: We conclude that 10 mcg/mL epinephrine solutions diluted in NS stored at 4°C is chemically and physically stable for 64 days, with 95% confidence. This allows the syringe to be held at room temperature for up to 24 hours during this period and still retain more than 90% of the initial concentration.

Compatibility and Stability of Ketamine and Ringers Lactate at Room Temperature (25°C)

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Background: IV Ketamine is widely used in our institution for both pain and sedation. However, many patients also receive an infusion of Ringers lactate. Compatibility of ketamine with Ringer's is unknown.

Objective: To evaluate the compatibility and stability of 1.5 and 7.6 mg/mL solutions of ketamine with Ringers lactate across a range of infusion rates at room temperature.

Methods: Ketamine solutions in saline, intended for infusion at rates between 2.6 and 99 mL/hr were mixed with Ringer's solutions intended for infusion at rates between 25 and 200 mL/hr. Solutions were evaluated for precipitate, changes in colour, temperature and evolution of gas at multiple times over a 24-hour period. To confirm compatibility, the stability and compatibility of ketamine concentrations of 1.5 and 7.6 mg/mL diluted directly in Ringer's lactate was evaluated at room temperature over 36 hours. Ketamine concentrations were determined

by a validated stability-indicating liquid chromatographic method with UV detection. The maximum chemical stability was determined based on the intersection of the lower limit of the 95% confidence interval of the observed degradation rate and the time to achieve 90% of the initial concentration.

Results: The analytic method separated degradation products from ketamine such that the concentration was measured specifically, accurately (deviations <2.0%) and reproducibly (<2%). In compatibility studies, changes in mixed solutions did not occur over the 24 hour period. In the stability study, ketamine solutions remained greater than 97% of the initial concentration over the 36 hour study period (chemical stability >36-hours) and no physical incompatibility was evident.

Conclusion: We conclude that 1.5 and 7.6 mg/mL concentrations of ketamine in Ringer's are physically compatible and chemically stable over 36 hours at room temperature. Furthermore, 1.5 and 7.6 mg/mL infusions of ketamine in saline are physically compatible with Ringers lactate infusions over 24 hours.

Retrospective Review of Vancomycin Dosing for Non-Central Nervous System Infections in Patients Admitted to the Neonatal Intensive Care Unit

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Background: Vancomycin is a common antibiotic prescribed in the neonatal intensive care unit (NICU) for gram-positive infections. However, achieving vancomycin therapeutic range is challenging in neonates, which led to revisions to our vancomycin dosing guideline in 2017.

Objectives: We evaluated the ability of the current vancomycin dosing guideline to achieve serum vancomycin therapeutic trough concentrations of 5-12 mg/L to treat non-central nervous system (CNS) infections in the NICU. We also assessed efficacy and safety outcomes of vancomycin courses.

Methods: A retrospective chart review was conducted on neonates admitted to the NICU and received vancomycin for suspected or documented non-CNS infections between April 1, 2017 and May 31, 2018. Patient baseline characteristics, vancomycin dose, trough concentrations and relevant laboratory results were collected.

Results: Total of 144 neonates or 169 vancomycin courses (77% empiric treatment and 23% for documented infections) were evaluated. Therapeutic vancomycin concentrations at steady state were achieved in 67% of neonates with post-menstrual age (PMA) <27 weeks who started vancomycin at 24 mg/kg/dose IV q24h, 66% of neonates with PMA of 27-36 weeks, who received 18 mg/kg/dose IV q12h and 57% of neonates with PMA ≥37 weeks dosed at 22.5 mg/kg/dose IV q12h. Over 30% of neonates with PMA <27 weeks or ≥37 weeks had subtherapeutic concentrations. Statistically significant decline in C-reactive protein was observed regardless of whether the first vancomycin concentration was subtherapeutic, therapeutic or supratherapeutic (p<0.05). No nephrotoxicity was observed based on serum creatinine, blood urea nitrogen or urine output.

Conclusions: Revised vancomycin dosing guideline led to increased proportion of patients achieving vancomycin therapeutic range at initial dose (64% vs. 49% using previous dosing guideline). However, vancomycin dosing can still be further optimized, especially for patients with PMA <27 weeks or ≥37 weeks using a pharmacokinetic model with considerations of relevant covariates.

Trends in Antimicrobial Resistance for *Enterobacter* spp. Collected from Inpatients at a Major Canadian Tertiary Care Center: A Retrospective Analysis over 14 Years

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Background: *Enterobacter* are opportunistic pathogens and a common cause of nosocomial infection. A recent study examined susceptibility trends among 719 *Enterobacter cloacae* isolates submitted to the CANWARD surveillance program between 2007-2016 and found resistance to ceftazidime, ceftriaxone, ertapenem, meropenem, and co-trimoxazole increased over time when a univariate test for trend was applied.

Objective: To evaluate antimicrobial resistance trends among *Enterobacter* isolates collected at Sunnybrook Health Sciences Center (SHSC) and compare findings to national CANWARD trends.

Methods: Susceptibility data for *Enterobacter* clinical isolates collected between October 2002 to September 2016 were retrospectively extracted from the SHSC Microbiology database. Univariate linear regression was used to evaluate changes in the percentage of isolates resistant to various antimicrobials at a significance level of 0.05.

Results: A total of 3181 *Enterobacter* isolates were identified across the 14-year study period (72% *E. cloacae* complex; 26% *E. aerogenes*; 2% other *Enterobacter* spp.). The majority of isolates grew from cultures drawn greater than 48 hours after admission (70%). Forty-eight percent were collected from ward patients, 35% from ICU patients, and 17% from patients in the emergency room. Resistance to ciprofloxacin, gentamicin, and tobramycin decreased across the study period (-0.6% resistant/year, p=0.0252; -1.0% resistant/year, p=0.0041; -1.0% resistant/year, p=0.0029; respectively). A signal suggesting reduced co-trimoxazole resistance was detected (-0.7% resistant/year, p=0.0562). In contrast, resistance to meropenem increased (+0.1% resistant/year, p=0.0023), and a signal suggesting increased piperacillin/tazobactam resistance was detected (+1.0% resistant/year, p=0.0566). Resistance to ceftazidime, ceftriaxone, and ertapenem remained relatively stable.

Conclusion: Increasing rates of meropenem resistance were found for CANWARD and SHSC *Enterobacter* isolates when univariate tests were applied; however, resistance trends for other antimicrobials differed between the SHSC and CANWARD datasets. Although validation with multivariate analyses is warranted, our findings suggest that knowledge of institutional resistance is important as differences from national trends may exist.

Patterns of Antimicrobial Resistance among *Proteus* Isolates at Sunnybrook Health Sciences Centre: A 14-Year Retrospective Observational Study

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Background: *Proteus spp.* are members of the *Enterobacteriaceae* family and common uropathogens. Wildtype strains of *P. mirabilis* are usually susceptible to ß-lactam antibiotics; however, the number of strains producing extended-spectrum ß-lactamases and AmpC enzymes is on the rise.

Objective: To investigate the antimicrobial resistance patterns among clinical isolates of *Proteus* spp. collected at Sunnybrook Health Sciences Centre (SHSC) over a 14-year study period.

Methods: Patient-level data for clinical isolates of *Proteus* spp. collected from inpatients between October 2002 and September 2016 were extracted from the SHSC Microbiology database and included in this retrospective observational study. Longitudinal trends in the susceptibility of these isolates to various antimicrobial agents were characterized using linear regression at a significance level of 0.05.

Results: Of a total of 1993 *Proteus* isolates identified, 1850 (93%) were *P. mirabilis*, 104 (5%) were *P. vulgaris*, and 39 (2%) were *P. penneri*. Among all isolates, 70% (1840/1993) were resistant to at least one therapeutically active antimicrobial agent. Although the proportion of *P. mirabilis* isolates resistant to piperacillin/tazobactam increased (-0.3% susceptible/year; p<0.001) and a signal suggesting increasing rates of ceftazidime resistance was also detected (-0.3% susceptible/year; p=0.087), the overall susceptibility to piperacillin/tazobactam (~99%) and ceftazidime (~97%) remained high. *P. mirabilis* susceptibility to ampicillin (~81%), cefazolin (~90%), ceftriaxone (~96%), ciprofloxacin (~88%), co-trimoxazole (~87%), gentamicin (~91%), meropenem (~100%), and tobramycin (~93%) remained stable over the 14-year study period. Patterns of resistance for *P. vulgaris* and *P. penneri* could not be reliably determined due to the low number of clinical isolates collected each year.

Conclusion: Antimicrobial resistance patterns of *P. mirabilis* at SHSC remained largely unchanged over the 14-year period assessed. All antimicrobials tested, with the exception of ampicillin, remain appropriate empiric treatment options against *P. mirabilis*.

Assessing the Use of a Standardized Allergy History Questionnaire in Patients with a Reported Penicillin Allergy

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Background: Inappropriate allergy labeling is associated with significant clinical and pharmacoeconomic implications. Detailed allergy assessments are a key component of antimicrobial stewardship and aid in identifying true immediate Type-1 hypersensitivity reactions. The allergy form currently used at the University Hospital of Northern British Columbia (UHNBC) relies on the assessor's unguided ability to ask appropriate prompting questions to obtain a thorough history.

Objective: The primary objective of this study was to compare the quality and quantity of documentation gathered from a standardized allergy history questionnaire to that of the current allergy history form.

Methods: This was a prospective observational study of patients admitted to medical and surgical services at UHNBC with a penicillin-family allergy reported on their Electronic Medical Record. An allergy report was processed using the health information software system and patients were interviewed using a detailed allergy history questionnaire.

Results: Forty percent of patients had an inappropriate allergy label on their EMR. Out of the 48 patients assessed, only 36 had a listed reaction on their EMR. Furthermore, only 36 of the 48 patients had the same allergy reported on the allergy history form in their paper chart, of which 22 had a documented reaction. The mean time to conduct the questionnaire was 2 minutes, ranging from 1 to 4 minutes to complete.

Conclusion: Documentation of allergy histories is often incomplete. Detailed allergy assessments are the first step in identifying true Immunoglobulin E (IgE)-mediated hypersensitivity reactions. Therefore, implementation of a standardized allergy history questionnaire may serve to improve documentation and overall antimicrobial stewardship.

Implementation of Spectrum, an Antimicrobial Stewardship App at a Community Hospital

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Background: Spectrum, an antimicrobial therapy reference app for healthcare professionals, was implemented by the Antimicrobial Stewardship Program (ASP) team to help reinforce appropriate prescribing practices in a community hospital.

Description: The Spectrum app is customized to deliver hospital specific antimicrobial therapy guidelines in an algorithmic format along with pathogen information and antimicrobial drug monographs.

Action: Content for the app was provided by the ASP team based on current guidelines along with local resistance patterns, the hospitals drug formulary, in-house diagnostic methods and the clinical expertise of the hospitals infectious disease physicians and pharmacists. Once content was incorporated into the app, it was reviewed by select Infection Control Practitioners, pharmacists and physicians at the hospital for accuracy and usability. Feedback was obtained and updates made to the content prior to hospital wide roll out. After extensive promotion to potential users the app was officially launched in November 2018.

Evaluation: Uptake of the app has been positive with 398 current active users. The majority of users are physicians or medical residents/students (57%) or pharmacists (22%). A survey was conducted following implementation which demonstrated that users are highly satisfied with the app with more than 90% of respondents scoring 7 or greater on a 10 point satisfaction scale. Appropriate prescribing of azithromycin for community acquired pneumonia was highlighted in the app and a concurrently released preprinted order set. Compared to the same time period in 2017, use of azithromycin was reduced by 29% following implementation.

Implications: Use of the Spectrum app appears to be an effective tool in positively influencing prescribing practices. Content will continue to be updated to encourage ongoing practice change.

Trends in Antimicrobial Resistance of *Citrobacter* Isolates Over a 14-Year Time Period

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Background: Antibiotic resistance is a global healthcare concern. *Citrobacter* spp. are nosocomial gram-negative bacterial pathogens with the potential for multidrug resistance. Unfortunately, because *Citrobacter spp*. have been classified as low priority pathogens, they have received little attention in the published literature.

Objective: To evaluate changes in antimicrobial resistance patterns of *Citrobacter* clinical isolates collected from inpatients at Sunnybrook Health Sciences Centre (SHSC), Toronto, Ontario over a 14-year time period.

Methods: Patient-level data for clinical isolates of *Citrobacter* spp. were retrospectively extracted from the SHSC Microbiology database from October 2002 to September 2016. Annual trends in ciprofloxacin, ceftazidime, ceftriaxone, co-trimoxazole, ertapenem, gentamicin, meropenem, and piperacillin/tazobactam resistance were assessed using linear regression at a significance level of 0.05.

Results: Of 1256 *Citrobacter* clinical isolates identified, 70% were from urine, 9% from blood, 8% from respiratory sources, and 13% from other

human specimens. Isolates were obtained from patients on the wards (52%), in the emergency department (29%), and in intensive care units (19%). Fifty-five percent of isolates were collected after 48 hours of hospital admission, and 45% were collected within 48 hours of admission. The most prevalent species were *Citrobacter freundii* (49%) and *Citrobacter koseri* (32%). Other species included *Citrobacter braakii* (6%), *Citrobacter amalonati* (4%), *Citrobacter farmer* (2%), and undifferentiated *Citrobacter* species (5%). *Citrobacter* spp. remained 100% sensitive to ertapenem and meropenem across the 14-year study period. Significant decreases in co-trimoxazole (-1.0% resistant/year; p=0.006) and gentamicin (-0.7% resistant/year; p=0.006) resistance were detected; whereas resistance to ciprofloxacin, ceftazidime, ceftriaxone, and piperacillin/tazobactam remained stable over time.

Conclusion: This study represents the first in Canada to evaluate changes in antimicrobial resistance of *Citrobacter* to specific antibiotic agents over an extended timeframe. This is valuable information for antimicrobial stewardship practitioners and compliments the growing body of literature on gram-negative bacterial resistance.

Evaluating the Efficacy and Safety of Buprenorphine Microdosing for Opioid Use Disorder: A Systematic Review

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Background: Buprenorphine is a high-affinity partial opioid agonist that can displace full agonists (e.g. heroin) from opioid receptors, precipitating withdrawal. To avoid this, patients are traditionally required to be in moderate withdrawal prior to buprenorphine induction. A novel method that eliminates the need for cessation of the full opioid agonist prior to induction uses microdoses (less than 2 mg) of buprenorphine. Little is known about the efficacy and safety of this method.

Objectives: This systematic review was conducted to determine if buprenorphine microdosing improves adherence and decreases relapse rates compared to traditional induction methods in adults with opioid use disorder.

Methods: A systematic literature search was conducted for all relevant publications using Medline, Embase, and PubMed (from database inception to September 16, 2019). Citations of retrieved articles were screened to identify other relevant articles. Articles were reviewed if buprenorphine induction began with a dose of less than 2 mg and overlapped with full opioid agonist use. Articles were not excluded based on study design.

Results: Seven studies met the inclusion criteria. All were case studies or series, totalling 11 patients. None of the studies had a comparator group or case. Patients were heterogenous with respect to the opioid agonist used, with two patients transitioning directly from methadone to buprenorphine. The microdosing induction duration ranged from three to 129 days. A low incidence of precipitated withdrawal was reported, however objective reporting using a validated tool was inconsistent. Two studies reported adherence rates, with one patient remaining on therapy at day 45, and another relapsed to illicit heroin use at three months.

Conclusions: These studies were heterogenous and commonly lacked objective and long-term outcome reporting. Larger, controlled, long-term studies should be conducted to assess the efficacy and safety of this novel induction method.

Wasting Better: An Interprofessional Evaluation of Narcotic and Controlled Drug Disposal Devices within a Pediatric Teaching Hospital

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Background: National and provincial standards for narcotics (and controlled drugs) require wasted drug to be altered or denatured to such an extent that consumption is impossible or improbable and then incinerated at a licensed facility. Historical adulterants like kitty litter and dish soap were not acceptable. Disposal of these medications in the garbage, sink or in biomedical waste also were not acceptable. Local audits of these standards revealed gaps in staff knowledge and a lack of standardized processes across clinical areas.

Description: Three different marketed narcotic waste devices were identified for use in patient care areas. RxDestroyer(Daniel's) uses an aqueous solution of activated charcoal and accepts anything. The Cactus SmartSink(Stryker) and Cactus PharmaLock (Stryker, liquid only) use absorbent gel, ipecac and other chemicals to render the contents altered and hopefully irretrievable.

Action: An interprofessional project team searched for a solution that for all patient care areas, which met all applicable standards and was simple to use. Clinical teams were presented information about local audits, identified gaps and possible solutions. Volunteers were then requested for participation in the evaluation process.

Evaluation: A pragmatic observational trial was designed to compare device capacity, security features, and user preferences. The devices were placed by consensus, after education and consultation with teams. Participating areas included: medicine, surgery, intensive care, operating rooms and recovery rooms. User experience, preferences and device limitations were captured as comments and quantitative preferences by online anonymous questionnaire. Overall users showed a preference for the Stryker devices. PharmaLock was best for procedural areas. All three devices had some problems reported, including overfilling, spill, and sharps/vials inserted.

Implications: This trial increased awareness about narcotic wasting standards and highlighted limitations of these devices in various clinical settings. Results need to be replicated at an adult site before the process is complete.

Pragmatic Observational Study of the Implementation of Narcotic and Controlled Drug Disposal Devices within a Pediatric Teaching Hospital

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Background: National and provincial standards for controlled substances require wasted drug to be altered or denatured to an extent that consumption is impossible or improbable, and then incinerated at a licensed facility. Historical adulterants like kitty litter and dish soap are not acceptable. Disposal of these medications in the garbage, sinks or in biomedical waste also are not acceptable. Local audits of these standards revealed gaps in staff knowledge and a lack of standardized processes across clinical areas.

Objective: To compare the cost, feasibility and user experience after implementation of narcotic waste devices in a pediatric teaching hospital, three devices were identified for trial. RxDestroyer(Daniel's) uses an aqueous solution of activated charcoal and accepts anything. The Cactus SmartSink(Stryker) and Cactus PharmaLock(Stryker, liquid only) use absorbent gel, ipecac, and other chemicals to render the contents altered and hopefully irretrievable.

Methods: Devices and installation location were selected in consultation with clinical teams. Each clinical area trialed two devices using a side by side or crossover design. Participating areas included inpatient medicine/surgery, intensive care, operating rooms, endoscopy and recovery rooms. User experience was collected using an anonymous online survey. Cost information was calculated using purchase costs, while study staff documented start and end weights for all waste canisters used.

Results: Procedural care areas preferred the PharmaLock device. The medicine/surgery team clearly preferred the SmartSink. Each team used each device for at least 75 days. Estimated disposal standardized to cost per Liter of waste in descending order: 64.80$(RxDestroyer), 32.06(SmartSink), 24.70$(PharmaLock). Amounts of waste generated varied greatly by location.

Conclusions: Liquids represented the vast majority of controlled waste. The most cost effective device was the PharmaLock. The volume of narcotic waste generated drives operating costs. Accurate cost estimates require implementation in an adult hospital.

Opioid Prescribing at Discharge for General Surgery Patients: A Prospective Study

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Background: The overprescribing of opioids is a contributing factor to Canada's opioid crisis. Recent studies have demonstrated that surgery patients generally use less opioids than what is prescribed at discharge.

Objective(s): The goal was to characterize our institution's discharge prescribing practices and correlate it with patient opioid use post-discharge to inform future quality improvement initiatives for optimizing opioid prescribing for general surgery patients.

Methods: A prospective cohort study using telephone questionnaires was performed from January 28 - May 31, 2019. Patient charts were reviewed for baseline characteristics and opioid use 24-hours pre-discharge. Patients were contacted 2 weeks post-discharge to assess their opioid usage, pain management experience, and if they received education for discharge opioid use and appropriate disposal while in-hospital. Data were analyzed using descriptive statistics.

Results: Thirty-five of 45 patients responded to the questionnaire (78% response rate; mean age 59.1 ± 16.1 years; 49% female). Though 33% of patients did not use any opioids in the 24-hours before discharge, all patients were prescribed opioids. On average, patients were prescribed 80.7 milligram morphine equivalents (MME). Ninety-one percent of patients had stopped using opioids at follow-up, and on average 53.5 MME per patient was unused. Though 86% of patients were satisfied with their pain control, 37% felt they had been over-prescribed opioids. Sixty-nine percent of patients received in-hospital education on how to use their discharge opioid, while 14% received education on appropriate disposal of unused medications. None of the patients had disposed their medications at time of follow-up.

Conclusion(s): In the general surgery population, a high proportion of opioids prescribed post-discharge are unused and undisposed, indicating that there is room for improvement for prescribing practices. Strategies to curb excess opioid prescribing and increase proper disposal, such as standardized opioid prescriptions, part fills, and increased inpatient education, should be explored.

Opioid Use Post Discharge from Hip and Knee Arthroplasty

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Background: Post arthroplasty surgery is a major source of opioid prescriptions and excess opioid prescriptions can lead to long-term use and diversion. A better characterization of opioid use may help guide future prescribing.

Objective(s): This quality improvement initiative aimed to describe opioid use in patients discharged from hip or knee arthroplasty, and to describe the relationship between outpatient opioid use, reported pain scores, and inpatient post-operative opioid consumption.

Methods: Patients undergoing elective hip or knee arthroplasty discharged with an opioid prescription were recruited for a telephone survey 2-3 weeks post discharge to assess opioid use and pain scores. Exploratory analysis compared opioid use in hospital and post discharge, and also compared outpatient opioid use and reported pain scores. All opioid doses were standardized to hydromorphone 1mg tablet equivalents. Paired t-test was used to compare means and Pearson correlation was used to describe correlation.

Results: Fifty-one patients were recruited, and 44 patients completed the survey (23 hip, 21 knee). Patients were prescribed an average of 100 (±38) tablets of hydromorphone 1mg equivalents. On average, patients with knee arthroplasty used 79 (±41) tablets post discharge while patients with hip arthroplasty used 64 (±48) tablets ($p=0.28$). The average pain score of patients at discharge was 7 (±2). Patients who reported a pain score of 7 or more used significantly more opioid tablets post discharge than patients with a pain score of less than 7 (88 (±44) tablets vs. 42 (±29) tablets, $p<0.01$). Opioid use in the 24-hour period before discharge was moderately correlated with opioid use post discharge ($R^2=0.59$, $p<0.01$).

Conclusion(s): The use of opioids by patients post knee or hip arthroplasty is highly variable. Pain score at discharge, opioid use in the 24-hour period before discharge, and surgery type may be used to individualize prescription quantities.

What Your Pharmacist Can Do for You: A Review of the Pharmacists' Role in an Allogeneic Hematopoietic Transplant Clinic

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Background: Pharmacists in clinic play an essential role in the care of post-allogeneic hematopoietic stem cell transplant (allo-HSCT) patients. Literature describing their role in this multidisciplinary setting is limited.

Objectives: This study aimed to capture pharmacists' activities in the pharmaceutical care of allo-HSCT patients, and to assess patient-perceived value of pharmacists in clinic.

Methods: Predefined selection criteria identified patients to be seen by a pharmacist. Pharmacists collected best possible medication histories (BPMHs), conducted medication reconciliation (MedRec), identified drug therapy problems (DTPs), made clinical recommendations and provided patient counselling. Data was collected from January 2018 to 2019. Patient satisfaction surveys were administered from January 7 to 28, 2019.

Results: The median number of patients per allo-HSCT clinic was 25 (range 6-42) and the median number seen by a pharmacist was 4 (range 1-9). Of those patients seen by a pharmacist, a median of 3 (range 1-8) had BPMH and MedRec completed, and 2 (range 1-6) received pharmacist-led counselling. A total of 806 DTPs were identified. The most common DTPs were: unnecessary drug (278, 34.2%), additional drug therapy required (235, 28.9%) and non-adherence (144, 14.0%). The median number of DTPs identified per clinic was 5.5 (range 1-15). Based on these DTPs, a median number of 6 recommendations were made by the pharmacist per clinic, with 5 being accepted by the prescriber. The overall acceptance rate was 96.4% (787/816). Fifty-six patients from the allo-HSCT clinic participated in the satisfaction surveys. Eighty-seven percent agreed or strongly agreed their interaction with the pharmacist had a positive impact on their care.

Conclusion: The pharmacist plays an integral role in the management of allo-HSCT patients in the ambulatory setting. Pharmaceutical care activities delivered by pharmacists in clinic are valued by both prescribers and patients.

Development and Evaluation of a Diabetes Education Program for Pharmacists

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Background: As part of a broader practice standardization project, an education program was developed focusing on a series of high risk, but commonly seen therapeutic topics. Diabetes management is a complex area of study that requires pharmacists to have minimal baseline knowledge in order to identify and resolve related drug therapy problems (DTPs).

Description: To ensure pharmacists possess the required knowledge and skills, a diabetes education module was developed, implemented and evaluated.

Action: The diabetes education module consisted of a voiced-over slideshow presentation, which included supporting institutional policies and procedures. The education module underwent review and feedback from expert and typical pharmacist users prior to deployment. Assessment of the pharmacist's knowledge and skills consisted of a 20-question multiple choice test that was administered both at baseline and after review of the module. Point-biserial (p-bis) and p-values were used to ensure test question validity and reliability. Pharmacists were required to score at least 80% on the post-module test. Program evaluation consisted of a questionnaire asking about the pharmacist's own confidence and of their colleagues to identify and resolve diabetes-related DTPs, and the perceived value of the program.

Evaluation: Fifty-four pharmacists completed the pre- and post-module tests. Post-module completion, the average test score increased from 80% to 95%. All pharmacists (54/54 [100%]) passed the test. Responses from the post-module questionnaire indicated that pharmacists were overall confident in their own and colleagues' ability to identify and resolve diabetes DTPs, and perceived the program as beneficial to improve patient care and safety.

Implications: The results suggest that pharmacists benefitted from a diabetes education program. Completion of the education module and post-module test are now mandatory for all new staff. Based on the program's success, future modules on different therapeutic topics are in development.

A Drug Use Evaluation of Proton Pump Inhibitors at a Canadian Teaching Hospital

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Background: Harms associated with chronic proton pump inhibitors (PPI) are of increasing concern. Since the 'Choosing Wisely Canada' PPI deprescribing recommendations were released, PPI usage has not been evaluated at our institution. We hypothesized that PPIs were over-utilized and that opportunities exist for use optimization.

Objectives: This study was designed to characterize PPI use in concordance with evidence-based assessment criteria derived from international guidelines.

Methods: A retrospective observational drug use evaluation (DUE) was conducted for a one year period (April 1, 2017 to March 31, 2018) at a Canadian, urban, university-affiliated, tertiary care centre. Inpatients prescribed at least one dose of PPI were included. The primary measures included the volume and characteristics of PPI orders, and the appropriateness of PPI use. Patients were identified using the pharmacy computer system. Patients' electronic charts were reviewed using a standardized data collection form. Descriptive statistical analyses were performed.

Results: A total of 617 patients with 1000 PPI orders were identified. The most common reasons for admission were cardiovascular [164 (27%)] and orthopedic [63(10%)] related. Fifty (8.1%) patients were treated for an UGIB resulting in 212 (21%) PPI orders. Of UGIB orders, 58 (39.7%) pre- and 51 (63.8%) post-endoscopy orders were deemed appropriate. Of non-UGIB orders, the most common indication was gastroesophageal reflux disease (171, 22%). More than half of orders [409/788 (52%)] were deemed to be appropriate based on route and indication. The most common serious PPI-related adverse effects experienced were hospital-acquired pneumonia (n=22) and *Clostridioides difficile* infections (n=10). Of discharge prescriptions for newly-started PPIs in hospital, the majority [153 (75%)] had no documented duration.

Conclusions: Approximately half of all PPI use at our institution was inappropriate. Opportunities to further optimize their use may be explored through order set modification or prescriber education.

Systematic Deprescribing of Proton Pump Inhibitors: Pilot Study in a Geriatric-Medicine Unit at a Community Teaching Hospital

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Background: Proton pump inhibitors (PPIs) are inappropriately prescribed in up to 50% of users. Long-term use of PPIs may be linked to increased risk of Clostridioides difficile infections, pneumonia, dementia, bone fractures and nutrient malabsorption.

Objective: To examine feasibility and impact of a PPI-deprescribing algorithm in alternate level of care (ALC) patients on a geriatric-medicine unit at a community teaching hospital.

Methods: This pilot project was a single center intervention with pre- and post-study design conducted on ALC patients in a geriatric-medicine unit. The primary outcome was composite of patients with PPI stopped or reduced. A PPI deprescribing algorithm was used to standardize deprescribing in eligible patients. A retrospective chart review was completed pre-intervention to determine deprescribing rate. In the intervention, the need for PPI was evaluated through chart review and discussion with patient/family and prescriber(s). In eligible patients, the dose was halved every 2 weeks with monitoring for adverse events until discharge. Patients had 4 week follow up post-discharge. Fisher's exact test was used for statistical analysis.

Results: A total of 72 patients were enrolled (n=36 pre, 36 post). Pre-intervention, 12 patients (31%) had their PPI deprescribed [9 patients (75%) had their PPI stopped, 3 patients (25%) had dose reduced]. Post-intervention, 25 patients (69%) had their PPI deprescribed [18 patients (72%) had their PPI stopped, 7 patients (28%) had dose reduced]. PPI deprescribing increased from 31% pre-intervention to 69% post-intervention (p=0.0043). Rebound symptoms were noted in one patient post intervention (2.7%).

Conclusion(s): A significant increase in PPI deprescribing was noted with intervention. Opportunities to improve feasibility include shortening the taper and reduction in post-intervention monitoring. This PPI deprescribing algorithm was successfully used in a medically stable, geriatric population within an acute care setting, and further research could be conducted to see the impact of widespread institutional use.

Documentation of Best Possible Medication History by Pharmacy Technicians in Ambulatory Care Clinics

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Background: In 2014, the organization implemented electronic Medication Reconciliation (eMedRec) for inpatients. In 2015, eMedRec was implemented in one ambulatory clinic to meet Accreditation standards. In January 2019, 28 ambulatory clinics were identified where "medication management is a major component of care" and where medication reconciliation must be provided.

Description: A key step in medication reconciliation is documenting the Best Possible Medication History (BPMH). Four of the qualifying ambulatory clinics requested that Pharmacy Technicians (Technicians) be trained to do this new work. Pharmacy was tasked to train and deploy Technicians to document the BPMHs for patients at their initial visits with a prescriber.

Action: Five Technicians were selected. BPMH training was a combination of: online education; hands on classroom training and; in clinic training with nurses already familiar with the computer system and task. In addition, Technicians learned how to access a scheduling resource to notify clinic clerks that they had obtained a BPMH. Biweekly meetings with clinic leaders were held to identify and resolve issues. Daily huddles were implemented to monitor completion of work in each clinic and reassign staff if needed to complete assigned work.

Evaluation: Quantity: The organization set a target of 90 % completion of BPMH prior or within 2 weeks prior to the initial visit. In September 2019 Technicians completed BPMHs for 89% of the initial visits. Quality: Since July 2, 2019 Technicians have documented approximately 1500 BPMHs. Since then we have received approximately 6 notes from physicians: 3 requested that the Technicians obtain BPMHs on follow up visits in addition to initial visits; 3 questioned inaccurate medication entries. All concerns were followed up and corrective action taken.

Implications: Utilizing Pharmacy Technicians to document BPMHs is an efficient option for ambulatory clinics.

The Comparison of Medication History Taken by Medical Team versus Pharmacy Team

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Background: Medication history (MH) taking is an essential part of a patient evaluation by medical team (MT) during admission to the hospital. To reduce errors, it's been suggested a pharmacy team (PT) to collect MH.

Objective: To compare the correctness and completeness of medication history taken by MT versus PT.

Methods: One thousand medication histories in 250 patients (4 MHs (1 in Emergency room (ER); 2 by the MT in 6 internal medicine wards (IMWs) (1 by the medical intern and 1 by the medical resident); and (1 by the PT in the IMWs) were reviewed. Patients with at least one home medication were entered into the study. The MH taken by each team was compared for correctness (the list of patient home medications as actually was) and completeness (all 5 drug parameters were recorded: name, dosage, frequency, daily dose, route of administration). Each parameter was scored and then summed up to make the comparisons.

Results: Male patients constituted 66.4% of the patients. Elderly patients (60 to 79 Years) comprised the majority (40.5 %). The range of home medications recorded by PT in MHs were 1-25 with the average (± SD) of 7 (±0.2) per patient, while the range of medications recorded by MT were 0-13 with the average (± SD) of 2.7 (±0.2) in the ER, and 0-18 with the average (± SD) of 4.13 (±0.2) in the IMWs. The correctness of MH by MT in the ER and the IMWs were 20% and 46.5% as opposed to 95.7% by PT. The completeness of MHs taken by MT in ER and the IMW were 20.27% and 47.97% as opposed to 95.78% by PT. Cardiovascular medications were the most problematic drug category (22.35%).

Conclusions: A PT is able to take a MH more correctly and completely than the MT.

Physical Assessment Educational Programs for Pharmacists and Pharmacy Students: A Systematic Review

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Background: Pharmacists continue to expand their scope of practice to include physical assessment (PA) as part of their management of drug therapy.

Objective: To describe programs developed to teach pharmacists/pharmacy students PA and identify factors associated with improved knowledge, confidence, and utilization.

Methods: We performed librarian-assisted searches of MEDLINE, Embase, and CINAHL using the terms "pharmacist", "student", and "physical assessment/examination", supplemented with manual bibliography searches. Studies published exclusively as abstracts were excluded. No language restrictions were applied. We extracted data on design, location, participants, methods of instruction, PA skills taught, assessment, utilization, and follow-up.

Results: The search yielded 526 citations, which were independently reviewed by 2 authors. Twenty-seven articles were reviewed in full and 15 were included. Most studies were conducted in the United States or Canada. Twelve studies enrolled pharmacy students (primarily second- or third-year), which focused on comprehensive PA skills or blood pressure measurement. Length of instruction ranged from a single session to a full-year course. Generally, any type of instruction improved knowledge and perceived importance of PA. Students preferred pharmacist instructors to other clinicians, and live subjects to simulators/manikins. Three studies evaluated courses for practising pharmacists, which included comprehensive PA instruction and consisted of 2-30 contact hours. Participants' confidence with performing PA improved in pre- to post-course surveys. One study showed improved confidence with performing PA 6 months after the course, while another study showed no improvement in confidence, but increased PA use, at 6 months post-course. Utilization of PA at after 6 months ranged from 49-65%.

Conclusions: A variety of programs have been developed to teach PA skills to pharmacists/pharmacy students. Broadly, sessions that included pharmacist instructors and live subjects to practice PA skills were preferred. Courses for practising pharmacists improved confidence with performing PA, but persistent confidence and utilization at 6 months were variable.

Exploring Medication Safety Culture in New Brunswick Pharmacies Using the Medication Safety Culture Indicator Matrix

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Background: Medication Safety Culture Indicator Matrix (MedSCIM) is a validated tool that is used to assess patient safety culture within a healthcare setting by inspecting the narrative information presented in medication incident reports.

Description: The objective of this study was to explore the medication safety culture in New Brunswick pharmacies by applying MedSCIM to assess medication incidents that reached patients.

Action: A total of 146 medication incidents involving patients anonymously reported by New Brunswick pharmacy professionals from January to June 2019 were included in this assessment. Using MedSCIM, we performed descriptive statistics and exploratory data analysis on the incidents.

Evaluation: Based on MedSCIM, maturity of patient safety culture can be measured by a two-dimensional 3-by-4 matrix: (1) Core Event Degree of Documentation (where 1 = fully complete; 2 = semi-complete; and 3 = incomplete report) and (2) Maturity of Culture to Medication Safety (where A = generative; B = calculative; C = reactive; and D = pathological). Of the 146 incidents that reached patients, the most common alphanumeric score was 2C (33%). Ratings 1C, 2B, and 1B were also relatively common, together accounting for 39% of the incidents. Eleven of the 146 incidents were associated with either mild or moderate patient harm. Of these, the vast majority (73%) were assigned a Level 1 rating, indicating that the documentation of most harm incidents were complete and included pertinent contributing factors.

Implications: Our MedSCIM analysis reveals that there is still work to be done to facilitate medication safety culture towards a more "system-oriented" or "generative" attitude. Our project offers a baseline or current view of medication safety culture in New Brunswick as the provincial mandatory medication incident reporting practice directive was recently implemented in November 2018. Striving for a "generative" safety culture can ultimately lead to optimization of patient outcomes.

An Assessment of Safety Culture in Saskatchewan Pharmacy Practice

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Background: As the scope of pharmacy practice is expanding, there is a growing interest to measure pharmacy professionals' attitudes on issues that pertain to patient safety as they impact patient outcomes and health care costs.

Description: The objective of this project was to explore the current perceptions and attitudes on patient safety culture in practice by Saskatchewan pharmacy professionals.

Action: We administered a 40-item online questionnaire, which was adapted from a validated Safety Attitude Questionnaire (SAQ) with 6 domains that could influence safety culture, to all 1262 registered pharmacy professionals in Saskatchewan. We conducted descriptive statistics and qualitative thematic analysis, accordingly, on the responses collected.

Evaluation: We collected 230 responses (210 pharmacist respondents and 20 pharmacy technician respondents) with an overall response rate of 18.23%. Pharmacy professionals had a fairly positive perception of safety culture in practice overall, scoring especially high in the domains of teamwork and safety culture. However, there was a concern with the level of staffing and inadequate training and supervision of new pharmacy personnel at the workplace, particularly regarding the integration of recently graduated pharmacy professionals. As well, pharmacy morale was inconsistently perceived by pharmacy professionals and varied depending on the type of pharmacy they worked in. Of the 6 domains

in the SAQ, working condition was scored the lowest by pharmacy professionals.

Implications: Although perception of safety culture in pharmacy practice is generally positive, the results of the SAQ show that there are still factors that generate discontentment from pharmacy professionals. Resolution of these barriers would contribute to a more robust safety culture within practice settings, and ultimately, improve the delivery of patient care.

Medication Incidents Associated with Patients with Renal Impairment: A Multi-Incident Analysis

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Background: Medication incidents associated with patients with renal impairment may result in increased exposure to medications, putting patients at risk of side effects, serious harm, or death. Healthcare professionals should learn from these incidents and adopt strategies to improve patient and medication safety.

Description: The objective of this multi-incident analysis was to gain a deeper understanding of the possible contributing factors to incidents associated with patients with renal impairment and to develop potential recommendations to prevent error recurrences.

Action: A total of 172 medication incidents associated with patients with renal impairment were extracted from a national incident reporting database from June 2014 to May 2019, with the subsequent performance of a qualitative and thematic analysis on 134 incidents that met the inclusion criteria.

Evaluation: Three main themes were identified from the multi-incident analysis, which included (1) recognition of renal impairment, (2) additional safeguards for patients with renal impairment, and (3) additional risks associated with renal impairment. Subthemes were further developed for each theme, which included (1a) assessment and availability of lab values, (1b) patient-related factors, (1c) medication-related factors, and (1d) documentation and computerization; (2a) accessibility to renal-specific care providers and (2b) special education provided to renal patients; and (3a) dialysis and (3b) drug therapy changes relating to renal function, respectively. Recommendations were offered for each corresponding theme identified from this analysis.

Implications: With an aging population at a higher risk of renal impairment, it is hoped that the findings from this analysis and the potential solutions presented can aid in the adoption of error reduction strategies and safe medication practices. Sharing lessons learned from medication incidents will contribute to overall safe and effective patient care.

Lessons Learned from a Multi-Incident Analysis on Medication Incidents Associated with Patient Harm in Saskatchewan

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Background: Medication incidents are preventable events, which may lead to patient harm, including adverse drug events, requirement of additional treatments, or critical events. By conducting a multi-incident analysis on reported harm incidents, system-based solutions can be developed to improve patient and medication safety.

Description: Multi-incident analysis is a qualitative methodology designed to derive common contributing elements amongst all reported incidents. Subsequently, potential recommendations to prevent incident reoccurrences can be developed. The objective of this multi-incident analysis was to gain a deeper understanding of the contributing factors to incidents associated with patient harm in Saskatchewan and to offer possible solutions.

Action: A total of 267 medication incidents associated with patient harm were extracted from a provincial incident reporting initiative from December 1st, 2017 to January 31st, 2019 and evaluated using a multi-incident analysis.

Evaluation: Four major themes were identified from the multi-incident analysis, which included (1) communication gaps, (2) non-traditional dispensing procedures, (3) order entry errors, and (4) product mix-up. Subthemes were further developed, which included (1a) patient communication, (1b) pharmacy staff communication, and (1c) interprofessional communication; (2a) compliance packaging and long-term care and (2b) high-risk procedures (e.g. methadone, compounding); (3a) technical errors and (3b) clinical errors; (4a) medication mix-up and (4b) patient mix-up, respectively. System-based recommendations were developed based on potential contributing factors identified for each sub-theme accordingly.

Implications: The thematic elements identified through the multi-incident analysis is applicable towards all medication-use practices. Sharing the findings of this analysis and the corresponding potential recommendations can aid with the adoption of error reduction strategies and promote safe medication practices. The importance of reporting, analyzing, and learning from past incidents should not be overlooked for continuous quality improvement in pharmacy practice.

Safety IQ: Lessons Learned from a Continuous Quality Improvement Program in Manitoba

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Background: Medication incidents involving patients are occurring and patient harm can be preventable. Twenty pharmacies in Manitoba participated in a standardized continuous quality improvement (CQI) program – Safety IQ – and retrospectively reported medication incidents to a national database anonymously.

Description: The objectives of this project were to apply a qualitative, multi-incident analysis approach to medication incidents that reached patients in Manitoba, to gain a better understanding of the contributing factors of these incidents, and to develop potential recommendations to prevent error recurrences.

Action: A total of 70 medication incidents involving patients were extracted from the Safety IQ provincial incident reporting initiative from July 2018 to June 2019 and a multi-incident analysis was conducted.

Evaluation: Four main themes were identified from the multi-incident analysis, which included 1) misidentification, 2) external discovery, 3) miscommunication, and 4) technology challenges. Subthemes were further developed for each theme (except for the last theme), which included (1a) patient misidentification, and (1b) product misidentification; (2a) patient/family/caregiver discovery and (2b) discovery by another healthcare professional; and lastly, (3a) miscommunication

between external healthcare professionals and pharmacy staff and (3b) miscommunication between patient and pharmacy staff. System-based recommendations were developed for each main them accordingly.

Implications: Confirmation of at least 2 patient identifiers by pharmacy staff will prevent unintentional mix-ups or misidentification of medications and patients. Using the "5 Questions To Ask About Your Medications" tool can help encourage and engage patient-healthcare professional dialogues. Findings from this analysis and potential recommendations presented would promote safe medication practices. Reporting, analyzing, and learning from anonymously reported medication incidents are critical for the success and ongoing engagement of pharmacy professionals in a provincial CQI initiative.

Intravenous Medication Safety – A Quantitative Analysis of Medication Incidents

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Background: Use of intravenous (IV) medications is ubiquitous in hospital practice. Awareness of the risk of medication-related harm is an important step towards system-level changes.

Objective: In order to determine future direction of medication safety, an analysis was conducted of IV medication incidents.

Methods: Using "drip", "IV", "intravenous", "infus*" as key search terms, the Individual Practitioner Reporting, Community Pharmacy Reporting, and Consumer Reporting databases from ISMP Canada's holdings and the National System for Incident Reporting database from the Canadian Institute for Health Information were queried for the period from October 2015 to September 2018. [National System for Incident Reporting, Canadian Institute for Health Information (October 18, 2018). Parts of this material are based on data and information compiled and provided by CIHI. However, the analyses, conclusions, opinions and statements expressed herein are those of the author, and not necessarily those of CIHI.]

Results: A total of 2210 reports related to IV medications were returned and total of 1583 reports were used for the quantitative analysis after screening and application of the exclusion criteria. For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/195/showToc

Conclusion: Of the top medications involved in harm reports, 3 are known high-alert medications. Their continued presence on this list highlights the need for additional safety strategies. The prominence of antimicrobials amongst the findings may be due to frequency of use but is deserving of further study.

Development, Dissemination and Evaluation of a "Direct Oral Anticoagulant Monitoring Tool" in Family Health Team Pharmacy Practice

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Background: Over the years, direct oral anticoagulants (DOACs) have quickly grown to favourable use over warfarin. However, regular monitoring is still imperative to ensure maximum safety and efficacy of these medications. Prior to this study, there was no standardized process for monitoring patients on DOACs in our hospital's family health team (FHT).

Description: The "DOAC Monitoring Tool" was developed and implemented at our hospital's FHT in an effort to facilitate the monitoring and documentation of patients on DOACs. The utility and acceptability of the tool was assessed thereafter.

Action: A monitoring form currently used in the hospital's outpatient pharmacy was adapted for use in the FHT setting based on input from literature and the FHT pharmacists. The tool was created as an electronic form compatible with Practice Solutions Suite, the electronic medical record used at the FHT. The tool was used whenever a pharmacist referral involved assessment of DOAC therapy. Proactive chart reviews of select high risk patients (individuals 80 years or older on a DOAC) were also conducted – however, this is not a regular task of the FHT pharmacists.

Evaluation: During the study period, 23 monitoring forms were completed. Three drug therapy problems were identified through the proactive chart reviews. The main barrier to uptake of the tool was the low number of requests made for DOAC-related pharmacy consults. Benefits of the tool include its ease of use and electronic accessibility. Limitations of the tool include its inability to highlight differentials between the therapeutic options and duplicate documentation in the patient chart.

Implications: Pharmacists can play a key role in the routine monitoring of DOACs and identification of drug therapy problems. Overall, the form was underutilized at our hospital's FHT. Piloting the form in other settings may provide additional information on the potential utility of the tool.

Optimizing the Management of Heart Failure: Diuretic Therapy at Discharge

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Background: Providing patients with diuretic instructions at discharge such as dose titrations based on weight is integral to heart failure management. There is currently no standardized approach at our centre for the provision and documentation of these instructions.

Objective: The goal was to characterize the management of patients admitted with heart failure to our institution, specifically focusing on what instructions are provided to them regarding diuretics at discharge.

Methods: The study was composed of a retrospective chart review of patients with a diagnosis of heart failure discharged June 1 to December 31, 2018 from our institution (General Internal Medicine and Cardiology units). An electronic survey was sent via email to 43 staff physicians on the GIM and Cardiology wards to better understand their perspective on diuretic instructions.

Results: The chart review included 84 patients. Most patients (96.4%) were discharged on a strong diuretic, mainly furosemide. Instructions regarding weight monitoring and diuretic titrations were provided to 25.9% and 14.8% of patients respectively. Many patients were advised to receive instructions from outpatient physicians; however, there were gaps in provision of follow-up instructions. Eighty percent of patients were advised to see their family physician, 54.8% to see a cardiologist, and 29.8% were referred to a heart failure clinic. Time to follow-up ranged from 1 to 6 weeks, and many patients were not given a recommended timeline. Only fifteen physicians completed the survey, and most mentioned that they provide diuretic instructions on discharge to heart failure patients. Some reasons for not providing instructions include lack of time and reliance on outpatient physicians to provide instructions.

Conclusion: Based on the chart review, most heart failure patients are discharged from our institution without receiving instructions on weighing themselves, adjusting their diuretics. More standardized approaches are needed for consistent provision and documentation of these instructions.

Roles and Perceptions of Pharmacists as Immunizers of Adult Patients in Tertiary Care Academic Hospitals: An Environmental Scan of Canadian Hospital Pharmacists

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Background: Vaccines are one of the most successful public health initiatives, yet adult vaccination rates remain low. Studies show hospitalization provides an opportunity to detect and address vaccination inadequacies; however, there is a lack of studies examining pharmacist vaccine advocacy roles in a hospital environment.

Objectives: The primary objective of this environmental scan was to identify the number of hospital pharmacists in Canada who self-identify as performing one of the following vaccine advocacy roles: educator, facilitator or administrator.

Methods: An electronic questionnaire, consisting of 52 pilot-tested questions, was distributed to pharmacists in tertiary care academic hospitals throughout Canada. The questionnaire was open for eight weeks and completed using the web-based Opinio™ software system. Closed-ended questions with specified response options were used to collect demographic data and personal practice information. The environmental scan was deemed to be a quality assurance project. Descriptive statistics were used to analyze data.

Results: Of the estimated 1967 hospital pharmacists in Canadian tertiary academic centers, 375 complete questionnaires were received, representing an estimated response rate of 19%. Most respondents, 87% (329/375) and 84% (315/375), reported engaging in at least one activity relating to education and facilitation, respectively. In contrast, only 41% (152/375) of respondents indicated they participate in at least one activity related to vaccine administration. Thirty-eight percent (142/375) of hospital pharmacists reported being currently certified to administer vaccines and only 13% (48/375) reported engaging in physical administration of vaccines. Nationally, 35% (131/375) of pharmacists were motivated to administer vaccines. The most common barrier reported was lack of time and the most common enabler was vaccine accessibility.

Conclusions: In Canada, most hospital pharmacists take on the roles of vaccine educators and facilitators. The vaccine administrator role is executed by hospital pharmacists less in comparison to the other vaccine advocacy roles.

Development of Geriatric Pharmacology Infographics (GPI): An Internet Survey among Health Care Professionals

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Background: Despite the increasing use of information design to deliver complex heath information, geriatric pharmacology information presented in visual form is a novel idea that may be efficient and effective. We created GPI prototypes (figure 1) with a clear hierarchy of important information and a systematic structure, using a graphic symbol system to better support clinical decision-making. We then evaluated them for further refinement.

Objective(s): To assess user-friendliness and overall reading experience of GPI, and to examine elements valued by clinicians to further refine the materials.

Methods: We recruited prescribers and pharmacists to elicit opinions about the prototypes through open-ended questions as part of a larger internet survey assessing efficacy and efficiency. We assessed appeal and user-friendliness, and used descriptive statistics to present results.

Results: Our survey had an 83.7% completion rate from 49 pharmacists, physicians, and nurse practitioners. Clinicians valued prescribing information (eg. adverse effects and monitoring parameters) but also visual elements, including organization and clarity of information. Conversely, additional elements, such as tapering and deprescribing recommendations would be helpful. Although many clinicians would make no changes to the GPIs, some felt that there was a learning curve for their use, and suggested the inclusion of a legend. 77.6% of respondents were satisfied with the overall appearance.

Conclusion(s): Geriatric pharmacology information design potentially conveys complex drug knowledge in a visually appealing way. We will further refine the GPIs to develop an innovative, scalable solution for use in medication optimization.

For the figure that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/195/showToc

Closed System Transfer Device Sterility Testing to Validate Beyond-Use Date Extensions

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Background: The Cancer Care Ontario Beyond-Use Date Recommendations Report outlines guidance on utilizing closed system transfer devices (CSTDs) with single-dose vials to extend beyond-use dates (BUDs) from the current 6 hours to 7 days. This is provided that annual facility level sterility testing is completed.

Objectives: Sterility testing evaluates the ability of CSTD components to maintain vial sterility after multiple withdrawals. This sterility testing validates vial BUD extensions.

Methods: All procedures were completed in an ISO Class 5 biological safety cabinet. Ten 100 mL vials of tryptic soy broth were punctured using Equashield® vial adaptors and 5 mL of broth were transferred from one vial into another 100 mL broth vial on days 1, 4 and 8. The original 10 vials were stored at room temperature and the 30 subsequent vials were incubated at 35°C ± 2°C for 14 days. Vials were visually monitored for growth on days 1, 4, 8, 15 and 22. Following incubation, 0.5 mL of broth was plated on tryptic soy agar and 0.5 mL on sheep blood agar. Plating was completed to validate the absence of microbial growth. Plates were incubated for 14 days. Growth rates were expected to be equal or lesser than 1.8% as reported in previous literature. A negative control vial and 3 positive control vials (*S. epidermidis, Bacillus subtilis, Staphylococcus aureus*) were incubated for 14 days.

Results: No vials displayed visual signs of turbidity and 0% of plates demonstrated microbial growth. All 3 positive control vials displayed turbidity and the negative control vial remained clear.

Conclusions: CSTD components demonstrated the ability to maintain sterility in facility level testing, thus validating BUD extensions. Overall, BUD extensions offer cost savings through reductions in medication wastage and facility sterility testing ensures patient safety.

Lipid-Based Formulation of a Vaccine Adjuvant Enhances Mucosal Immunity

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Background: A triple adjuvant (TriAdj) comprised of innate defense regulator (IDR)-1002 peptide, poly(I:C), and polyphosphazene has shown promise for use in vaccines. A lipid-based formulation of TriAdj (L-TriAdj) was developed and assessed for mucosal and systemic immunological responses to intranasal vaccination.

Objective(s): To design and characterize a cationic lipid-based delivery system for nasal administration of TriAdj and determine its *in vivo* efficacy.

Methods: Lipidic cationic formulations (L-TriAdj) were characterized using particle sizing, zeta potential, mucin binding and electron microscopy. L-TriAdj with ovalbumin was administered intranasally to mice as a model vaccine. Control groups included saline, TriAdj without lipid, and antigen only. Serum and lymphocyte assays of IgG, IgA, IL-5 and TNF-α were performed to determine the systemic and mucosal immune response. ANOVA with Tukey's post hoc tests were performed and comparison was done on rank order-transformed data with the Kruskall-Wallis test and Tukey post hoc test ($p<0.05$).

Results: L-TriAdj formed a condensed cationic complex with a mean diameter of <200 nm. The most stable formulation (comprised of 50:50 mol:mol didodecyl dimethylammonium bromide and dioleoyl phosphatidylethanolamine) was chosen for *in vivo* assessment. Mice administered L-TriAdj vaccines intransally showed a significantly greater immune response than those administered vaccines with TriAdj alone, with no signs of toxicity. A balanced Th1/Th2 immune response demonstrated the superior systemic and mucosal immunity of the L-TriAdj formulation. Notably, IgA levels in serum were significantly greater in vaccinated mice receiving the lipid-based formulation.

Conclusion(s): The lipid formulation of TriAdj enhanced its mucosal and systemic efficacy following intranasal administration. The optimal formation of L-TriAdj generated the greatest immune response at the lowest antigen dose. This optimized formulation is currently being explored for several intranasal vaccines.

Clinical Pharmacy Key Performance Indicators and Pharmacist Job Satisfaction: A Mixed-Methods Study of Canadian Hospital Pharmacists

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Background: The clinical pharmacy Key Performance Indicators (cpKPIs) are a set of measures for quality improvement. Although they have links to important impacts on patient outcomes such as hospital readmissions, there is no data relating to their impact on Canadian hospital pharmacists' job satisfaction.

Objectives: To determine the level of job satisfaction among Canadian hospital pharmacists, and whether participation in the cpKPIs contributes to hospital pharmacist job satisfaction.

Methods: A mixed-methods study was conducted. An electronic survey was developed using a validated pharmacist job satisfaction tool and distributed nationally to hospital pharmacists between January 30 - March 14, 2019. Focus groups were conducted with pharmacists locally to further explore activities that contribute to their job satisfaction.

Results: Overall, 284 pharmacists from 9 provinces completed the electronic survey. The mean job satisfaction score among Canadian hospital pharmacists was 3.93 out of 5 (SD = 0.85). Job satisfaction scores increased as self-identified time spent performing the cpKPIs increased ($r = 0.148$, $p = 0.014$). Pharmacist satisfaction was found to increase with time spent performing medication reconciliation on admission ($\beta = 0.140$, $p = 0.032$) and decrease with time spent identifying and resolving drug therapy problems (DTPs) ($\beta = -0.153$, $p = 0.030$). However, pharmacists described the most reward on average from identifying and resolving DTPs in comparison to the other cpKPIs. As well, perceived reward from the identification and resolution of DTPs was found to have a positive association with job satisfaction ($\beta = 0.205$, $p = 0.013$). In focus group discussions, some cpKPIs were highlighted favourably, although pharmacists described some ambivalence towards patient education. The importance of having an impact, and receiving appreciation was highlighted.

Conclusions: Canadian hospital pharmacists are in general satisfied with their jobs, and participation in the cpKPIs was found to be positively associated with hospital pharmacist job satisfaction.

What Clinical Pharmacy Key Performance Indicators (cpKPI) Are Patients Receiving across Canada? A National cpKPI Patient Registry and Pooled Analysis

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Background: National consensus clinical pharmacy key performance indicators (cpKPIs) represent processes of care associated with an impact on meaningful patient outcomes. Hospitals across Canada have begun measuring and reporting cpKPI data on a local level, however, variations exist regarding which cpKPIs are measured and cpKPI practice profiles. Currently, a Canadian registry does not exist to capture cpKPI patient-level data and track pooled national progress.

Objective: To develop a national cpKPI patient registry and generate pooled national summary cpKPI reports to inform the advancement of pharmacy practice and improve patient outcomes.

Methods: In this national, quality improvement, observational study, volunteer hospitals measuring at least one cpKPI were enrolled and submitted aggregate cpKPI patient data for January - December 2018. Local hospital cpKPI data were summarized and pooled national reports were generated.

Results: In the inaugural year, 32 Canadian hospitals and 275,896 patients were enrolled. Of the 32 hospitals, 19 hospitals were acute care institutions, continuously measuring cpKPIs as patient proportions (core analysis). The most commonly delivered cpKPIs were Admission Medication Reconciliation, Pharmaceutical Care Plans, Drug Therapy Problems Resolved and Inter-professional Patient Rounds.

Conclusions: The first national registry for capturing cpKPI patient-level data in Canada was established. The results from this registry will facilitate identification of strengths, care gaps and opportunities for the provision of cpKPI-related processes of care across the country, permit hospital cpKPI profile benchmarking, cpKPI definition refinement, and support national best-practice sharing.

For the figure that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/195/showToc

Implementation of Streamlined Electronic Workflow to Capture Key Performance Indicators (KPIs) for Pharmacists

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Background: Clinical Pharmacy Key Performance Indicators (cpKPIs) measure the quality of care provided by hospital pharmacists. Both workload documentation and chart documentation are required and important tasks of pharmacists however, it is a challenge to fit into the daily routine.

Description: Our goal was to implement the documentation of eight KPIs as defined by the CSHP Canadian cpKPI Collaborative and integrate the process within existing pharmacist workflows. A simplified workflow was created to include KPI documentation as part of the pharmacists' daily responsibilities, while maintaining workload collection.

Action: We embedded KPI documentation within the patient's electronic health record as it utilized existing workflows, simplified documentation, and is configurable to retrieve data for reporting. We assigned time values, based on practice leads consensus, to individual KPIs, thus removing the need to separately perform workload documentation. The new tool was rolled out after education on functionality and definitions of the various KPIs. Individual pharmacists received their own KPI data monthly as well as a satisfaction survey.

Evaluation: There were 22 pharmacists who responded to the survey. A majority (86%) of pharmacists documented KPIs on a daily basis. All respondents found the KPI process easy to use, and majority (90%) agreed the new process better enables task completion compared to previous methods. 64% of respondents agreed KPI data will assist with refining their own practice, and 77% agreed KPIs are an important reflection of their hospital practice.

Implications: Results suggest that the new process has simplified compliance to workload and KPI documentation, in addition to self-reflection of practice. In future, reports will be automatically generated and emailed to each pharmacist with monthly data.

Analysis of Pharmacist Clinical Documentation after CST Cerner Transformation

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Background: Lions Gate Hospital in Vancouver recently implemented Cerner, a new clinical information system replacing paper records. This switch changes how pharmacist's document, but having electronic records allows for easier workload statistics evaluation, and benchmarking of patient outcomes. Since Cerner implementation, pharmacist documentation has not been evaluated, so it is important to learn from their experiences before Cerner is implemented at other locations.

Description: The Canadian Society for Hospital Pharmacists have developed 8 clinical pharmacy key performance indicators (cpKPI). To use cpKPI's for benchmarking, there must first be a way to collect data and measure the cpKPI. Therefore, this project looked at both how current pharmacist documentation matches the cpKPI's, and whether the system allows for easy data collection and cpKPI measurement.

Action: General workload statistics were generated. Additionally, a sample of *pharmacist-notes* were mapped to cpKPI's. These notes were analyzed for how well the content matched to the note type and title, and it was assessed whether it was possible to map the notes based on the note type and title alone.

Evaluation: There were 7691 *intervention-notes* and 7667 *pharmacist-notes* created. It was not always clear how a *pharmacist-note* would map, due to non-descriptive titles and because most *pharmacist-note* types had variable content, mapping to 2-6 cpKPI's. Five of the 8 *pharmacist-note* types mapped fairly consistently, however the remaining 3 were the most frequently used and had the most variability and non-descriptive titles. For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/195/showToc

Implications: By evaluating strengths and weaknesses of pharmacist documentation in the current Cerner system, these results can be used to inform future use. Accurate cpKPI implementation allows for improvement in quality of care, and helps advance pharmacy practice.

Missing Dose Message Audit Using a Closed-Loop Health Information System - A Pharmacy Quality Improvement Project

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Background: Missing doses are a common time-consuming issue in hospitals. EPIC, an electronic health information system, has a secure InBasket messaging function that allows efficient exchange of messages between nurses and pharmacy technicians without using the phone. Missing dose messages are routed to a single InBasket for technicians to triage.

Description: The objectives were to observe the workflow of pharmacy technicians related to InBasket messaging and to identify the causes of missing doses submitted by nurses using the messaging function. The final step was to identify potential areas for improvement.

Action: A total of 80 missing dose messages were received from the ICU and Internal Medicine units over 4 days between the hours of 0600-1000. Potential causes for the missing doses were investigated and organized into 7 categories. The time taken per message by the technician was also recorded.

Evaluation: A number of missing doses were due to relocated and misplaced medications. In 18% of cases, nurses located the medication on the unit. In 25% of cases, the dispensed medication was not found on the unit. The remaining cases were either lost on patient transfer (16%), not yet prepared (15%), or confirmed as missing (6%). In 11% of cases, the message was incorrectly titled as missing, rather than refill required. Technicians spent less than 10 minutes resolving each message.

Implications: An electronic messaging function is an efficient communication tool between nursing and pharmacy, which allows re-ordering and documentation of missing doses. Recommendations include: 1) implementing pre-formatted phrases in the InBasket function to encourage consistent replies, 2) adding MAR notes to identify refrigerated medications, and 3) education on the appropriate labelling of the message. Potential causes of missing doses should continue to be evaluated for process improvement.

Discrepancies in "As Needed" Medications Prescribed during Hospitalization and at Discharge

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Background: Hospital discharges are an interface of care where patients are at high risk of medication discrepancies as they transition from the hospital to their home. Thus, discrepancies at discharge may result in significant consequences on the health care system due to the financial waste and increased potential for adverse patient outcomes.

Description: The objective was to review medication administration records and discharge medication reconciliation prescriptions to identify discrepancies. This included both PRN medications recently used in hospital and not ordered at discharge (potentially untreated condition) and PRN medications not recently used in hospital and ordered at discharge (potentially unindicated use).

Action: A randomized retrospective chart review including 76 patients was conducted in April 2019. Patients included were aged 18 years or older admitted to hospital longer than 7 days, had an electronic chart scanned, had PRN medication(s) prescribed during their hospitalization, and had a medication reconciliation form at discharge.

Evaluation: This study was able to identify and quantify discrepancies related to PRN medications at the interface between hospitalization and discharge. Seventy-nine per cent of patients (60/76) received at least one dose of PRN medication in the seven days before discharge. Twenty-nine percent of those patients (17/60) used PRN medications in the last 7 days of hospitalization but were not prescribed any at discharge. Twenty-one per cent of patients (16/76) did not have any doses of PRN medication in the 7 days before their discharge but 44% (7/16) of these were prescribed a PRN medication at discharge.

Implications: Reviewing the need for PRN medications on discharge is important for adequate management of patients' symptoms at home and to prevent potential unnecessary medication use. The current PRN medication administration record makes this review very time-consuming. New procedures should be considered to prevent polypharmacy and medication errors at discharge.