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Drug Shortages: More than Just Background Noise

Susan K Bowles

The *Canadian Journal of Hospital Pharmacy* (*CJHP*) first published an editorial regarding drug shortages in 2012.[1] Almost 7 years later, this issue of *CJHP* includes a study comparing several aspects of drug shortages among Canada and 4 European countries, serving to remind us that the drug shortage problem is far from resolved. Videau and others[2] found that across all 5 study sites, drug shortages occurred on a daily basis, predominantly affecting injectable products. Furthermore, shortages could be prolonged: in the Canadian study hospital, the median duration was 32 days, but shortages could last longer than a year, with the longest reported shortage being 402 days.[2] These data are consistent with those reported by Drug Shortages Canada, which currently (as of early 2018) estimates about 300 shortages, affecting vaccines, chemotherapeutic agents, antibiotics, and other drugs commonly used in the hospital setting.[3] Indeed, drug shortages have become so commonplace that some pharmacists have come to consider this issue as the "background noise" of today's hospital pharmacy practice (Stephen Shalansky, Providence Healthcare, Lower Mainland Pharmacy Services; personal communication, November 8, 2018).

Drug shortages can arise at multiple points throughout the supply chain. For example, there may be shortages or contamination of raw materials or active ingredients, manufacturing issues related to quality control, production delays, and contracting issues such as reliance on a single supplier.[4] Pharmacy departments do their best to alleviate the impact of this common problem, but there is no doubt that despite these efforts, drug shortages have the potential to negatively affect patient care.

First, drug shortages can directly affect patient outcomes. For example, shortages of chemotherapeutic agents can delay treatment, lead to use of reduced doses, or require substitution of therapies not supported by evidence, potentially affecting survival rates.[5] Likewise, shortages of anesthesia medications have been reported to delay surgery or necessitate substitution of agents associated with prolonged recovery time or protracted postoperative nausea and vomiting, potentially resulting in increased length of stay and poorer overall surgical outcomes.[6] Shortages of norepinephrine in US hospitals have been associated with increased mortality among patients with septic shock.[7] The Institute for Safe Medication Practices (US) reported 1 death that was partially attributed to a delay in treating sepsis-related acidosis with sodium bicarbonate during a recent shortage.[8]

Second, the use of unfamiliar medications or different strengths, concentrations, and formulations, which may occur during a shortage, increases the risk of medication error.[9] Areas of particular risk have been outlined by the Institute for Safe Medication Practices Canada (ISMP Canada).[9] For example, use of alternative drugs, concentrations, strengths, or dosage forms introduces potential for error across the medication-use system in the prescribing, preparation, administration, and/or monitoring processes.[9] Furthermore, these alternative therapies may not be included in the hospital's usual resources, such as order sets, parenteral drug therapy manuals, or smart pump libraries.[9] Two surveys of US health care personnel highlighted this risk. Among 300 health care personnel responding to the 2017 survey, of whom about two-thirds were pharmacists, at least 1 error was reported by 21% of respondents, and among the errors reported, several involved high-risk medications, such as opioids, potassium chloride, and epinephrine.[8] In the earlier survey, conducted in 2010, at least 1 near miss was reported by 35% of the 1800 respondents.[10] ISMP Canada has reported 1 incident related to a shortage of topical epinephrine in which parenteral epinephrine 1:1000 was substituted for a local anesthetic; the incorrect drug was drawn up into an unlabelled syringe, then administered by injection into the operative site, resulting in cardiac arrest and death.[11]

Third, drug shortages also have indirect effects on patient safety. In the same US survey referenced above,[8] more than one-third of respondents provided comments about the human and financial resources required to manage drug shortages. In particular, they noted that time spent managing drug shortages

diverted them from time usually spent on patient care and medication safety activities, which resulted in greater risk for error.[8] This increased risk of error may be due, in part, to the effect that drug shortages can have on workload, fatigue, and mental distraction for front-line staff.[9] Pharmacists and pharmacy technicians also reported that other health care professionals frequently express their frustration with drug shortages directly to pharmacy staff, which leads to poor morale and further increases the risk for error.[8]

Drug shortages pose a risk to patients for many reasons. Pharmacists and pharmacy technicians should be proud of the work they do every day to mitigate that risk. That only a few serious negative patient outcomes have been reported attests to the importance of pharmacy staff on the front line of patient safety. Yet it is easy to lose focus when faced with an ongoing problem that requires our continuous vigilance. Given the potential for patient harm, drug shortages are clearly more than just background noise. We need to remember that and work toward more permanent solutions to the drug shortage problem.

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Pénuries de médicaments : plus qu'un simple bruit de fond

par Susan K Bowles

Le *Journal canadien de la pharmacie hospitalière* (JCPH) a publié en 2012 un premier éditorial sur les pénuries de médicaments[1]. Près de sept ans plus tard, le présent numéro du JCPH comprend une étude comparant plusieurs aspects des pénuries de médicaments au Canada et dans quatre pays d'Europe, ce qui nous rappelle que le problème est loin d'être réglé. Videau et collab.[2] ont remarqué que les cinq lieux à l'étude étaient quotidiennement confrontés à des pénuries de médicaments, principalement en ce qui concerne les produits injectables. De plus, la durée des pénuries pouvait se prolonger : dans l'hôpital canadien à l'étude, la durée médiane était de 32 jours, mais certaines pénuries pouvaient durer plus d'un an, la plus longue ayant été signalée avait d'ailleurs sévi pendant 402 jours[2]. Ces données correspondent à celles émises par Pénuries de médicaments Canada, qui, depuis le début de 2018, estime à environ 300 le nombre de pénuries touchant des vaccins, des antinéoplasiques, des antibiotiques et d'autres médicaments employés régulièrement en milieu hospitalier[3]. En effet, les pénuries de médicaments sont à ce point fréquentes que certains pharmaciens en sont venus à considérer ce problème comme le « bruit de fond » de la pratique de la pharmacie hospitalière d'aujourd'hui (Stephen Shalansky, Providence Healthcare, Services de pharmacie des basses-terres continentales; communication personnelle, 8 novembre 2018).

Les pénuries de médicaments peuvent affecter plusieurs endroits de la chaîne d'approvisionnement. Par exemple, il peut y avoir des pénuries ou une contamination des matériaux de base ou des principes actifs, des problèmes de fabrication liés au contrôle de la qualité, des retards de production et des problèmes de fournisseurs, par exemple quand on ne compte que sur un seul fournisseur[4]. Les services de pharmacie font de leur mieux pour réduire les impacts de ce problème courant, mais il est certain que, malgré ces efforts, les pénuries de médicaments peuvent avoir une influence négative sur la qualité des soins offerts aux patients.

Premièrement, les pénuries de médicaments peuvent avoir un impact direct sur les résultats thérapeutiques. Par exemple, les pénuries d'antinéoplasiques peuvent retarder le traitement, mener à l'utilisation de doses réduites ou nécessiter le recours à un traitement qui n'est pas fondé sur des données probantes, ce qui peut avoir des répercussions sur les taux de survie[5]. On a signalé également que les pénuries d'anesthésiants retardaient des opérations chirurgicales ou obligeaient l'emploi de médicaments de substitution associés à une prolongation de la convalescence ou à des nausées et à des vomissements postopératoires prolongés, ce qui mène potentiellement à de plus longs séjours hospitaliers et, globalement, à de moins bons résultats chirurgicaux[6]. Les pénuries de norépinéphrine dans des hôpitaux des États-Unis ont été associées à une augmentation des taux de mortalité chez les patients subissant un choc septique[7]. L'Institute for Safe Medication Practices (États-Unis) a signalé un décès ayant été partiellement attribué au retard du traitement au bicarbonate de sodium d'un sepsis lié à l'acidose pendant une pénurie récente[8].

Deuxièmement, l'emploi de médicaments moins connus ou dont la puissance, les concentrations et la forme pharmaceutique ont été modifiées, ce qui peut se produire lors d'une pénurie, augmentent les risques d'erreur médicamenteuse[9]. Les sphères de risque particulier ont été mises en lumière par l'Institut pour l'utilisation sécuritaire des médicaments du Canada (ISMP Canada)[9]. Par exemple, le recours à des médicaments, à des concentrations, à des puissances ou à des formes pharmaceutiques autres fait apparaître un potentiel d'erreur dans l'ensemble du système d'utilisation des médicaments, que ce soit lors de la prescription, de la préparation, de l'administration ou du processus de suivi[9]. De plus, ces traitements de substitution peuvent ne pas apparaître dans les ressources habituelles de l'hôpital, comme les ensembles de modèles d'ordonnances, les manuels sur les médicaments parentéraux ou les bibliothèques de pompes intelligentes[9]. Deux sondages soumis à des membres du personnel en santé aux États-Unis ont mis en lumière ce risque. Parmi les 300 membres ayant répondu au sondage de 2017, et dont près des deux tiers étaient pharmaciens, 21 % des répondants ont signalé au moins une erreur, et parmi les erreurs déclarées, plusieurs mettaient en cause des médicaments associés à un risque élevé, comme les opioïdes, le chlorure de potassium et l'épinéphrine[8]. Dans le sondage précédent, mené en 2010,

35 % des 1 800 répondants ont déclaré au moins un incident évité de justesse[10]. ISMP Canada a signalé un accident lié à la pénurie d'épinéphrine topique, laquelle a été substituée par de l'épinéphrine parentérale 1:1 000 pour une anesthésie locale; le mauvais médicament a été placé dans une seringue sans étiquette, puis administré par injection dans le site opératoire, ce qui a mené à un arrêt cardiaque puis au décès[11].

Troisièmement, les pénuries de médicaments ont aussi des effets indirects sur la sécurité des patients. Dans le même sondage réalisé aux États-Unis, mentionné ci-dessus[8], plus du tiers des répondants ont écrit des commentaires à propos des ressources humaines et financières nécessaires à la gestion des pénuries de médicaments. Ils ont indiqué plus particulièrement que le temps passé à s'occuper des pénuries de médicaments leur enlevait le temps qu'ils consacraient normalement aux soins des patients et aux activités portant sur la sécurité des médicaments, ce qui menait à des risques d'erreur plus importants[8]. Cette augmentation du risque d'erreur pourrait, en partie, être la conséquence de l'effet que les pénuries de médicaments peuvent avoir sur la charge de travail, la fatigue et les distractions mentales du personnel de première ligne[9]. Les pharmaciens et les techniciens en pharmacie ont aussi indiqué que d'autres professionnels de la santé exprimaient souvent directement au personnel de pharmacie leur frustration à propos des pénuries de médicaments, ce qui minait le moral et augmentait encore davantage les risques d'erreur[8].

Bref, pour plusieurs raisons, les pénuries de médicaments représentent un risque pour les patients. Les pharmaciens et les techniciens en pharmacie peuvent néanmoins se sentir fiers de leur travail quotidien pour réduire ce risque. En effet, le faible nombre de résultats thérapeutiques négatifs graves signalés témoigne de l'importance du travail du personnel de la pharmacie, qui est aux premières lignes de la sécurité des patients. Or il est facile de relâcher son attention lorsqu'on fait face à un problème permanent qui nécessite une vigilance constante. Compte tenu de leur potentiel de nuisance pour les patients, les pénuries de médicaments sont manifestement plus qu'un simple bruit de fond. Nous devons garder cela à l'esprit et travailler à des solutions permanentes pour régler ce problème.

[Traduction par l'éditeur]

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Drug Shortages in Canada and Selected European Countries: A Cross-Sectional, Institution-Level Comparison

Manon Videau, Lotfi Chemali, Cyril Stucki, Mar Saavedra-Mitjans, Samuel Largana, Aurélie Guerin, Pascal Bonnabry, Blaise Delhauteur, Thierry Van Hees, Denis Lebel, and Jean-François Bussières

ABSTRACT

Background: Drug shortages represent a complex global problem affecting patients and health care professionals on a daily basis.

Objectives: To identify, describe, and compare drug shortages in health care facilities in Canada and 4 European countries in early 2018.

Methods: A descriptive cross-sectional study was conducted in 1 hospital in each of 5 countries: Canada, France, Belgium, Spain, and Switzerland. Over a 4-week period, shortage data were collected daily by each hospital using a standardized grid and a standard process.

Results: From January 8 to February 2, 2018, there were a total of 84 shortages (median duration 32 days) in the Canadian hospital, 62 shortages (median duration 9 days) in the French hospital, 46 shortages (median duration 37 days) in the Belgian hospital, 28 shortages (median duration 25 days) in the Spanish hospital, and 98 shortages (median duration 68 days) in the Swiss hospital. The number of manufacturers implicated in the shortages was 28 for the Canadian hospital, 30 for the French hospital, 19 for the Belgian hospital, 16 for the Spanish hospital, and 42 for the Swiss hospital. Most of the shortages involved parenteral drugs, with both innovative and generic manufacturers being affected. Most therapeutic classes were affected by shortages to some extent, with the top 3 classes being anti-infective agents (accounting for 21.1% of shortages overall), central nervous system drugs (11.3%), and cardiovascular drugs (8.2%).

Conclusions: Drug shortages occurred almost daily in all of the study hospitals. Across the 5 hospitals, the frequency of shortages varied by a factor of 3, which may imply similar variability at the national level. All stakeholders should work more diligently to prevent and manage drug shortages.

Keywords: drug shortages, pharmaceutical practice, drug supply

RÉSUMÉ

Contexte : Les pénuries de médicaments représentent un problème mondial complexe qui touche quotidiennement les patients et les professionnels de la santé.

Objectifs : Recenser, décrire et comparer les pénuries de médicaments ayant eu lieu au début de 2018 dans des établissements de soins de santé du Canada et de quatre pays d'Europe.

Méthodes : Une étude descriptive et transversale a été menée dans un hôpital de chacun des cinq pays suivants : le Canada, la France, la Belgique, l'Espagne et la Suisse. Sur une période de quatre semaines, chaque hôpital a recueilli quotidiennement les données sur les pénuries à l'aide d'une grille et d'un processus normalisés.

Résultats : Pour la période allant du 8 janvier au 2 février 2018, on a recensé 84 pénuries (durée médiane de 32 jours) dans l'hôpital canadien, 62 pénuries (durée médiane de 9 jours) dans l'hôpital français, 46 pénuries (durée médiane de 37 jours) dans l'hôpital belge, 28 pénuries (durée médiane de 25 jours) dans l'hôpital espagnol et 98 pénuries (durée médiane de 68 jours) dans l'hôpital suisse. Vingt-huit (28) fabricants étaient impliqués dans les cas de pénuries dans l'hôpital canadien, 30 dans l'hôpital français, 19 dans l'hôpital belge, 16 dans l'hôpital espagnol et 42 dans l'hôpital suisse. La plupart des pénuries touchaient les médicaments parentéraux et mettaient en cause tant les fabricants de médicaments novateurs que ceux de médicaments génériques. Les pénuries ont affecté d'une manière ou d'une autre la plupart des classes de médicaments , mais les trois classes les plus touchées étaient les agents anti-infectieux (21,1 %) les médicaments agissant sur le système nerveux central (11,3 %) et les agents cardiovasculaires (8,2 %).

Conclusions : Des pénuries survenaient presque quotidiennement dans chaque hôpital de l'étude. Dans l'ensemble des hôpitaux, la fréquence des pénuries variait selon un facteur de trois, ce qui pourrait se traduire par une variabilité semblable à l'échelle nationale. Toutes les parties prenantes doivent travailler avec plus d'ardeur à la prévention et à la gestion des pénuries de médicaments.

Mots clés : pénuries de médicaments, pratique pharmaceutique, approvisionnement en médicaments

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INTRODUCTION

The World Health Organization (WHO) views drug shortages as a complex global challenge.[1] Numerous signs point to the growing importance of this issue, particularly in Europe and North America.[2,3] One of the most striking examples in recent years in Canada was the Sandoz crisis, which involved a production slowdown and shortages of hundreds of injectable drugs. As a result, warning letters were issued to Sandoz Canada by the US Food and Drug Administration in 2011 and 2012. Although the problem of shortages affects many countries, there is still too little information available to allow researchers to determine the extent and characteristics of this phenomenon internationally.[4] Moreover, international benchmarking of drug shortages on the basis of available data is difficult, because a uniform definition of drug shortages is lacking.[5] For example, the WHO recently identified 56 definitions of drug shortages currently in use around the world.[6]

Drug shortages have become a major public health issue, and international bodies such as the WHO, the International Pharmaceutical Federation, and the European Association of Hospital Pharmacists are increasingly undertaking initiatives to prevent and address such shortages.[7-10] However, the measures taken, including formal regulations, vary widely from one country to another.[4] In terms of the regulatory framework, notification of drug shortages to one or more national authorities has been mandatory since 2004 in France,[11] since 2006 in Belgium,[12] since 2010 in Spain,[13] and since 2015 in Switzerland.[14] In Canada, such declarations have been mandatory only since 2017.[15] More generally in Europe, article 23a of directive 2001/83/EC of the European Commission specifies that market authorization holders for products marketed in member states of the European Union are required to give 2 months' notice to regulatory authorities when market access to a product will be temporarily or permanently interrupted.[16]

In the hospital setting, pharmacists must ensure the supply of drugs to meet the needs of all patients and must responsibly manage the integrity of the supply chain (e.g., appropriate allocation of available quantities of drugs through prioritization of patients).[17] Therefore, it is important for pharmacists to stay informed about ongoing shortages, remain proactive in addressing them, and know what alternative resources are available to treat patients.

Regardless of the cause of a drug shortage, the consequences for public health can be serious and are unlikely to respect national borders.[1,18] Furthermore, despite existing measures, drug shortages remain a major problem affecting patients and clinicians on a daily basis.[19] A study of national-level data, published in 2017, found more drug shortages in Canada than in France, although the number of shortages was similar in a sample hospital from each country.[20] The study reported here therefore aimed to supplement and expand upon those earlier data by identifying, describing, and comparing drug shortages in 1 representative health facility from Canada and each of 4 European countries.

METHODS

This descriptive cross-sectional study involved 1 hospital in each of 5 countries. Drug shortage data were obtained from a university hospital in each of Canada (456 acute care beds), France (600 beds), Spain (600 beds), and Switzerland (1000 beds) and from a general hospital in Belgium (900 beds). The French and Canadian hospitals bought drugs through drug wholesalers, whereas the hospitals in the other 3 countries obtained drugs directly from the manufacturers. The hospitals were identified through previous collaborations with our Canadian research unit. In each hospital, an individual hospital pharmacist or a pair of workers (consisting of a pharmacist and a pharmacist student) were identified to provide the requested data.

Data Sources and Data Extraction

For the purpose of this study, a drug was defined as a product having a specific content, form, or size that was obtained from a particular manufacturer (e.g., amoxicillin, 500-mg capsules, box of 100 capsules, Mylan). If more than one drug manufacturer was in shortage for a given medication in a given national market, the shortage of that medication was counted as a single event for the hospital. A drug shortage was identified by failure on the part of the supplier to deliver an ordered product to the hospital, because of a supply problem for the product at the particular supplier; no time criteria were applied, because failure to deliver an ordered product to a hospital may have consequences, regardless of the duration of the shortage. Participating personnel at each hospital collected the data daily from January 8 to February 2, 2018, using a standardized grid (Excel spreadsheet, Microsoft Corporation) and a standard data-collection process. To ensure a complete set of data for drug-related shortages during the study period, all active shortages known by the data collectors in their respective hospitals were documented on January 8, and any new shortages that occurred during the study period were recorded.

From the data collected, a start date and an end date (date of return to stock or withdrawal from the market) were identified for each drug in shortage. When the actual start and end dates of the shortage were known, these dates were used. Otherwise, the estimated start date of the shortage and the estimated date of return to stock were used to calculate the duration of the shortage. For drugs with an estimated date of return to the market later than February 2, 2018, the end date was arbitrarily defined as February 2, 2018. For each drug in short supply, we identified the manufacturer, type of manufacturer (innovative or generic), therapeutic class (according to the Anatomical Therapeutic Chemical Classification System or the American Hospital Formulary Service classification), and the route of administration (parenteral or otherwise).

In addition, for each drug shortage, we collected the source of the information about the shortage, the main cause of the shortage, the presence of a national guideline concerning the particular shortage, the function of the person who was primarily responsible for managing the shortage within the hospital, any action taken to address the shortage, and an estimate of the time required to manage the shortage (e.g., to gather information, communicate with patients and colleagues, search for and order alternative treatment, or perform pharmaceutical compounding in the pharmacy).

Descriptive Analysis

For each country, we calculated the number of drugs in short supply, the average or median duration of shortages (according to the data distribution), the number of manufacturers implicated by shortages, the proportion of drug shortages associated with generic drugs, and the proportion of shortages involving drugs administered by the parenteral route. Also, respondents were asked to identify additional management strategies and tools in place.

Comparison of Drug Shortage Ratios

For each hospital, the drug shortage ratio was defined as the ratio of total number of shortages identified to the total number of drugs normally in stock at the facility. Drug shortage ratios are reported for the 5 hospitals.

RESULTS

Descriptive Analysis

From January 8 to February 2, 2018, there were a total of 84 drug shortages in the Canadian hospital, 62 in the French hospital, 46 in the Belgian hospital, 28 in the Spanish hospital, and 98 in the Swiss hospital. The median duration of drug shortages was 32 days (range 0–402 days) in the Canadian hospital, 9 days (range 2–437 days) in the French hospital, 37 days (range 1–263 days) in the Belgian hospital, 25 days (range 0–240 days) in the Spanish hospital, and 68 days (range 0–1771 days) in the Swiss hospital (Table 1). The majority of drugs in short supply were for parenteral administration (60.1%). Overall, the main therapeutic classes affected by drug shortages were anti-infective agents (21.1% of shortages overall), central nervous system agents (11.3%), cardiovascular drugs (8.2%), and antineoplastic agents (7.5%). Table 1 also shows the number of manufacturers affected by at least 1 drug shortage and the proportion of shortages involving generic drug manufacturers. The top 5 manufacturers involved in drug shortages across all 5 hospitals were Pfizer (9.7%), MSD (6.3%), Mylan (6.0%), Sanofi (6.0%), and GSK (5.0%) (Table 2).

Comparisons

For calculating the drug shortage ratio at each hospital, the total number of drugs normally in stock was 2032 for the Canadian hospital, 2034 for the French hospital, 1419 for the Belgian hospital, 2345 for the Spanish hospital, and 2362 for the Swiss hospital. The drug shortage ratios were calculated as 4.13%, 3.05%, 3.24%, 1.19%, and 4.15%, respectively.

Qualitative Analysis

The main sources of information regarding drugs in short supply were manufacturers (53.8% of all shortages) and wholesalers (45.3%) (Table 3). In 73.9% of cases, the cause of the shortage was unknown. For the remaining shortages, the causes were an increase in demand (19.8% of all shortages), a manufacturing problem (1.9%), lack of raw material (1.6%), discontinuation of a product (i.e., product had been taken off the market; 1.6%), a quality defect (0.6%), or a natural disaster or other incident (0.3%). For 95.9% of the shortages, national guidelines for managing drug shortages were not available, and each hospital managed their shortages through additional stocking. The personnel who managed shortages varied across the institutions: pharmacists (50.0% of shortages), administrative staff (30.5%), or pharmacy technicians (18.9%).

Depending on the drug concerned, management of a shortage could be more or less complicated, in terms of both seeking alternatives and communicating the shortage to other health professionals. For more than half of the shortages (57.9%), respondents estimated that they spent no more than 30 min managing the shortage. Only 6.3% of shortages required more than 120 min. The main actions taken to manage drug shortages within the study hospitals were using another product (44.0% of shortages), obtaining the drug from another supplier (8.5%), importing the product from abroad (5.7%), and changing the institution's practices (5.3%).

Participating pharmacists were asked to identify additional management strategies and tools in place within their respective institutions. Paradoxically, only pharmacists in the Spanish, Swiss, and Canadian hospitals used the national website for reporting drug shortages in their practices. Furthermore, only the hospitals in these 3 countries had a policy for increasing critical drug inventory levels, and only the hospitals in Switzerland and Canada had strengthened pertinent clauses in their calls for tender requiring pharmaceutical companies to develop plans to prevent breaks in the drug supply (i.e., a risk management program).

DISCUSSION

This descriptive study characterized drug shortages in a single hospital centre in each of 5 countries over a 4-week period in early 2018. According to calculated drug shortage ratios, the shortages seemed to be most important in the Swiss and Canadian hospitals, affecting just over 4% of the drugs normally in stock. Shortages affected between 3% and 4% of drugs normally in stock in the Belgian and French hospitals (in descending order) and only about 1% of drugs normally in stock in the Spanish hospital.

Table 1. Quantitative and Therapeutic Profile of Drug Shortages in a Representative Hospital in Each of 5 Countries

Variable	Country; No. (%) of Shortages*					
	Canada (*n* = 84)	France (*n* = 62)	Belgium (*n* = 46)	Spain (*n* = 28)	Switzerland (*n* = 98)	Total (*n* = 318)
Quantitative profile						
No. of drug manufacturers with ≥ 1 shortage	28	30	19	16	42	135
Duration of drug shortage, days†						
Mean ± SD	55 ± 61	35 ± 83	51 ± 47	51 ± 63	186 ± 301	91 ± 186
Median (range)	32 (0–402)	9 (2–437)	37 (1–263)	25 (0–240)	68 (0–1771)	31 (0–1771)
No. of drug shortages from generic manufacturers	48 (57)	28 (45)	4 (9)	12 (43)	33 (34)	125 (39.3)
No. of shortages involving parenteral drugs	41 (49)	29 (47)	31 (67)	17 (61)	73 (74)	191 (60.1)
Therapeutic class‡						
Anti-infective agents	15 (18)	18 (29)	7 (15)	8 (29)	19 (19)	67 (21.1)
Central nervous system agents	13 (15)	11 (18)	1 (2)	5 (18)	6 (6)	36 (11.3)
Cardiovascular drugs	7 (8)	7 (11)	3 (7)	1 (4)	8 (8)	26 (8.2)
Antineoplastic agents	1 (1)	6 (10)	1 (2)	5 (18)	11 (11)	24 (7.5)
Gastrointestinal drugs	3 (4)	0 (0)	4 (9)	0 (0)	3 (3)	10 (3.1)
Skin and mucous membrane preparations	9 (11)	0 (0)	4 (9)	4 (14)	7 (7)	24 (7.5)
Hormones	5 (6)	0 (0)	6 (13)	2 (7)	1 (1)	14 (4.4)
Anesthetics, local	5 (6)	2 (3)	5 (11)	0 (0)	2 (2)	14 (4.4)
Antihistamines	3 (4)	1 (2)	0 (0)	0 (0)	0 (0)	4 (1.3)
Autonomic drugs	6 (7)	1 (2)	1 (2)	1 (4)	3 (3)	12 (3.8)
Diagnostic agents	3 (4)	0 (0)	3 (7)	0 (0)	3 (3)	9 (2.8)
Electrolytic, caloric, and water balance agents	2 (2)	4 (6)	3 (7)	0 (0)	5 (5)	14 (4.4)
Ointments, ophthalmic agents	3 (4)	1 (2)	2 (4)	0 (0)	3 (3)	9 (2.8)
Serums, toxoids, vaccines	2 (2)	3 (5)	0 (0)	0 (0)	9 (9)	14 (4.4)
Smooth muscle relaxants	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)
Vitamins	1 (1)	0 (0)	0 (0)	1 (4)	1 (1)	3 (0.9)
Radioisotopes	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	1 (0.3)
Enzymes	0 (0)	1 (2)	0 (0)	0 (0)	1 (1)	2 (0.6)
Blood formation and coagulation agents	0 (0)	1 (2)	3 (7)	0 (0)	4 (4)	8 (2.5)
Blood derivatives	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (0.3)
Expectorants and cough preparations	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (0.3)
Other	5 (6)	6 (10)	3 (7)	0 (0)	10 (10)	24 (7.5)

SD = standard deviation.
*Except where indicated otherwise.
†For drugs with an estimated date of return to the market later than February 2, 2018, the end date was arbitrarily defined as February 2, 2018, for purposes of calculating the duration of shortage.
‡According to the classification of the American Hospital Formulary Service.

These data seem to confirm the existence of a drug shortage problem in hospitals in many countries. However, the number of drug shortages varied by a factor of 3 across the study hospitals, which may suggest important variability among countries. In other words, although drug shortages are a global problem, their importance in particular countries seems disparate. Bochenek and others[4] reported similar data from a survey conducted in 2017 in 28 countries in Europe and West Asia. Indeed, over the 3 years preceding their study, those authors observed a trend toward increasing drug shortages in France and Switzerland, and decreasing shortages in Belgium and Spain.

In the study reported here, the numbers of shortages were higher in the Canadian and Swiss hospitals than in the hospitals in the other 3 countries. No specific cause could be identified to explain these differences. At the international level, parallel drug export within the European Union might explain some of the drug shortages. Some countries, including France, have introduced legal requirements for wholesalers and pharmaceutical companies to address drug shortages; in France, these requirements include the obligation to implement a management plan for drug shortages of major interest (e.g., drugs for which treatment interruption is likely to be life-threatening) and a prohibition on export of any of these drugs.[21] Similar measures are in place in other European countries, such as Spain, where the Spanish Agency for Medicines and Health Products may adopt measures to limit excessive export of medicinal products when

Table 2. Drug Shortages by Manufacturer

Manufacturer	Country; No. (%) of Shortages*					
	Canada (*n* = 84)	France (*n* = 62)	Belgium (*n* = 46)	Spain (*n* = 28)	Switzerland (*n* = 98)	Total (*n* = 318)
Accord Healthcare	0 (0)	2 (3)	0 (0)	2 (7)	0 (0)	4 (1.3)
Apotex	8 (10)	0 (0)	0 (0)	0 (0)	0 (0)	8 (2.5)
Arrow Pharmaceuticals	0 (0)	5 (8)	0 (0)	0 (0)	0 (0)	5 (1.6)
Aspen Pharmacare	4 (5)	2 (3)	0 (0)	0 (0)	4 (4)	10 (3.1)
B. Braun	0 (0)	1 (2)	4 (9)	0 (0)	3 (3)	8 (2.5)
Baxter	1 (1)	0 (0)	0 (0)	0 (0)	1 (1)	2 (0.6)
Bayer	0 (0)	1 (2)	0 (0)	1 (4)	4 (4)	6 (1.9)
Bristol-Myers Squibb	0 (0)	1 (2)	0 (0)	0 (0)	2 (2)	3 (0.9)
Fresenius Medical Care	1 (1)	0 (0)	0 (0)	0 (0)	5 (5)	6 (1.9)
GSK	3 (4)	2 (3)	1 (2)	2 (7)	8 (8)	16 (5.0)
Hospira	0 (0)	1 (2)	0 (0)	1 (4)	0 (0)	2 (0.6)
Janssen Pharmaceutical	0 (0)	1 (2)	1 (2)	0 (0)	0 (0)	2 (0.6)
Kern Pharma	0 (0)	0 (0)	0 (0)	2 (7)	0 (0)	2 (0.6)
Meda Pharmaceuticals	0 (0)	0 (0)	3 (7)	0 (0)	0 (0)	3 (0.9)
Merck & Co	0 (0)	0 (0)	0 (0)	1 (4)	1 (1)	2 (0.6)
MSD	0 (0)	4 (6)	8 (17)	0 (0)	8 (8)	20 (6.3)
Mylan	1 (1)	11 (18)	5 (11)	2 (7)	0 (0)	19 (6.0)
NextPharma	0 (0)	0 (0)	0 (0)	0 (0)	5 (5)	5 (1.6)
Novartis	1 (1)	1 (2)	1 (2)	0 (0)	2 (2)	5 (1.6)
O&M Movianto	0 (0)	0 (0)	6 (13)	0 (0)	2 (2)	8 (2.5)
Pfizer	15 (18)	2 (3)	3 (7)	6 (21)	5 (5)	31 (9.7)
Pharmascience	10 (12)	0 (0)	0 (0)	0 (0)	0 (0)	10 (3.1)
Sandoz	6 (7)	3 (5)	2 (4)	0 (0)	1 (1)	12 (3.8)
Sanofi	1 (1)	5 (8)	2 (4)	3 (11)	8 (8)	19 (6.0)
Stiefel Laboratories	0 (0)	0 (0)	0 (0)	2 (7)	0 (0)	2 (0.6)
Teva Pharmaceutical Industries	9 (11)	3 (5)	0 (0)	2 (7)	0 (0)	14 (4.4)
Other	24 (29)	17 (27)	10 (22)	4 (14)	39 (40)	94 (29.6)

*A value of zero indicates that either the company did not hold a contract with the particular study hospital or the company had no shortages with the hospital during the study period.

a drug is the sole product of its kind available on the Spanish market.[22] Paradoxically, although parallel export restrictions are enforceable in other countries, they are not applied in Belgium.[4]

The median duration of drug shortages varied widely in this study, from 9 days in the French hospital to 68 days in the Swiss hospital. Given such long-term unavailability, it seems unlikely that drug shortages could be prevented simply by increasing stocks. Drug shortages have forced hospitals to develop new management strategies (e.g., identification of more than 1 provider for each drug, delay or deferral of care or procedures, prioritization of indications for medication therapy). Drug shortages thus raise concerns about continuity of care, as well as financial and ethical issues. Overall, maintenance of sufficient inventory, development of decision support tools, and optimization of inventory management are therefore essential. Indeed, Russell and others[23] showed, through an analytical decision model, that in times of scarcity, efficiency-based allocation can lead to treatment for more patients than a "first come, first served" policy.

In the current study, the number of manufacturers implicated in the occurrence of at least 1 drug shortage ranged from a low of 16 (for the Spanish hospital) to a high of 42 (for the Swiss hospital). In all but the Belgian hospital, a high proportion of generic companies were involved in drug shortages; however, shortages were not limited to generic companies. The low profitability of the generics market, particularly in relation to price reduction and payment caps determined by governments, can contribute to drug shortages and to reductions in the number of manufacturers for a given market.[24-26] Thus, although a single-sourcing procurement strategy can save money in the short term, it may contribute to drug shortages in the long term, by causing many potential suppliers to exit the market. In Belgium, the low profitability of generic drugs has led many generic drug companies to decline participation in tenders, and this trend can be expected to extend to biosimilars.[27,28]

More than half of the drug shortages in this study involved parenteral drugs, similar to data reported from the United States and several European countries.[29,30] Increased regulatory requirements (e.g., good manufacturing practices) and controls at production sites have probably weakened the current market. Indeed, among the known causes of shortage, quality defects and manufacturing problems represented a total of 2.5% (8/318) of the shortages identified in this study. However, this is not a coincidence if shortages are affecting mainly drugs with more

Table 3. Qualitative Profile of Drug Shortages in Each Hospital

Variable	Country; No. (%) of Shortages					
	Canada (*n* = 84)	France (*n* = 62)	Belgium (*n* = 46)	Spain (*n* = 28)	Switzerland (*n* = 98)	Total (*n* = 318)
Data source used to identify drug shortages						
Wholesaler	82 (98)	60 (97)	0 (0)	2 (7)	0 (0)	144 (45.3)
Manufacturer	2 (2)	0 (0)	46 (100)	25 (89)	98 (100)	171 (53.8)
Website	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0.0)
Drug regulatory authorities	0 (0)	2 (3)	0 (0)	1 (4)	0 (0)	3 (0.9)
Other institutions	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0.0)
Other	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0.0)
Cause of shortage						
Shortage of raw material	0 (0)	1 (2)	0 (0)	2 (7)	2 (2)	5 (1.6)
Manufacturing problem	0 (0)	2 (3)	4 (9)	0 (0)	0 (0)	6 (1.9)
Quality defect	0 (0)	0 (0)	1 (2)	0 (0)	1 (1)	2 (0.6)
Increasing demand	54 (64)	0 (0)	0 (0)	0 (0)	9 (9)	63 (19.8)
Product discontinued	4 (5)	0 (0)	0 (0)	1 (4)	0 (0)	5 (1.6)
Natural disaster or other incident	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (0.3)
Unknown	26 (31)	59 (95)	40 (87)	25 (89)	85 (87)	235 (73.9)
Other	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)	1 (0.3)
Presence of national directive or regulation for managing shortage*						
Yes	0 (0)	2 (3)	0 (0)	10 (36)	1 (1)	13 (4.1)
No	84 (100)	60 (97)	46 (100)	18 (64)	97 (99)	305 (95.9)
Personnel in charge of managing shortage†						
Pharmacist	2 (2)	7 (11)	46 (100)	6 (21)	98 (100)	159 (50.0)
Pharmacy technicians	5 (6)	55 (89)	0 (0)	0 (0)	0 (0)	60 (18.9)
Administrative personnel or management	77 (92)	0 (0)	0 (0)	20 (71)	0 (0)	97 (30.5)
Other	0 0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0.0)
Unknown	0 (0)	0 (0)	0 (0)	2 (7)	0 (0)	2 (0.6)
Estimated time spent on managing shortage						
< 15 min	57 (68)	55 (89)	0 (0)	5 (18)	0 (0)	117 (36.8)
15–30 min	16 (19)	0 (0)	46 (100)	5 (18)	0 (0)	67 (21.1)
31–60 min	0 (0)	2 (3)	0 (0)	6 (21)	85 (87)	93 (29.2)
61–120 min	0 (0)	0 (0)	0 (0)	1 (4)	7 (7)	8 (2.5)
> 120 min	3 (4)	5 (8)	0 (0)	6 (21)	6 (6)	20 (6.3)
Unknown	8 (10)	0 (0)	0 (0)	5 (18)	0 (0)	13 (4.1)
Actions implemented during shortage						
Used product still in stock‡	30 (36)	53 (85)	5 (11)	1 (4)	4 (4)	93 (29.2)
Obtained drug from another health facility	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0.0)
Obtained drug from another supplier	21 (25)	0 (0)	4 (9)	2 (7)	0 (00)	27 (8.5)
Used another product	11 (13)	0 (0)	37 (80)	17 (61)	75 (77)	140 (44.0)
Imported drug from another country	0 (0)	2 (3)	0 (0)	3 (11)	13 (13)	18 (5.7)
Modified practices of the health facility	10 (12)	5 (8)	0 (0)	1 (4)	1 (1)	17 (5.3)
Other	2 (2)	0 (0)	0 (0)	3 (11)	5 (5)	10 (3.1)
Unknown	10 (12)	2 (3)	NA	1 (4)	NA	13 (4.1)

NA = not applicable.
*Depending on the type of drug in short supply, the drug regulatory authorities may or may not issue recommendations to ensure patient safety during the shortage.
†The person managing a shortage may differ according to the type of drug in shortage or the reason for the shortage; for example, some actions implemented during a shortage may require the skills of a pharmacist.
‡Health facilities usually have a stock of about 2 weeks for the main drugs used. Therefore, when a drug is in short supply at the manufacturer, it may take a few days or a week before the hospital's stock declines to zero. Sometimes, however, the stock is insufficient to meet needs during a manufacturer's shortage, and other actions must be implemented.

complex and costly manufacturing processes and low profit margins. Shortages of different drugs do not carry the same risk of medication incidents, and we believe that shortages of parenteral drugs are generally more critical. Indeed, the size of the market and the limited number of competitors often result in single-source drug production for an entire country. In contrast to the situation in Canada, membership in the European Union and the greater population density of European countries may

promote competition and increase the number of alternatives available in national markets in Europe. We might therefore question the role of the European Union in the occurrence and prevention of drug shortages. Fostering trade between countries and importing products from abroad would probably mitigate the impact and consequences of drug shortages. Paradoxically, current measures, especially those in European countries, tend to limit exchanges of products to protect each country's population from the health risks associated with drug shortages. In addition, Health Canada allows, by exception, the importation of drugs without market authorization when required on an urgent basis.[31] The same is true in Switzerland and Belgium, where, in the event of a stock-out situation, the holder of market authorization must apply to market a foreign drug for a limited period.[32-34]

Many causes of shortages have been identified in the literature.[35-37] However, the causes are usually unknown, as was the case for 73.9% of the shortages in our study. This result points to a substantial lack of transparency in the pharmaceutical industry. For instance, pharmaceutical companies are not required to disclose the production sites of drugs. As a result, it can be difficult to anticipate shortages of specific drugs when a single plant is facing manufacturing issues, and it is correspondingly difficult for pharmacists to guard against drug shortages in their daily practice. Although shortages differ in terms of their importance and the associated risks for patients, each shortage represents administrative and pharmaceutical concerns that will increase workload for the entire staff of an institution and will similarly increase the risk of errors.

Participants in this study generally spent no more than 30 min managing each shortage (57.9% of cases) because they had another locally available solution (e.g., some product still in stock, an alternative option readily available). Thus, management of only 6.3% of the drug shortages identified required more than 120 min; in these cases, more complex actions were needed, such as modification of the hospital's practices or importation of products from abroad. De Weerdt and others[38] investigated the time spent by Belgian hospital pharmacists on supply problems and drug shortages. They found that the median time spent on drug supply problems was 109 min/week (minimum 40 min/week, maximum 216 min/week). With an average of 7 new drug shortages per week in the facilities in our study, each requiring 15 to 30 min of time, our results are therefore of the same order of magnitude (total weekly time 105 to 210 min).

This study has highlighted a substantial disparity in drug shortages among hospitals in different countries. In the face of this problematic situation, the government, regulatory authorities, and health care professionals in each country have set up their own tools to prevent and manage drug shortages.

Comparisons across different countries should allow hospitals and pharmacists to learn from experiences elsewhere, and the value of such comparisons should not be underestimated. In addition, establishing effective communication networks and creating ongoing collaborative relationships among all stakeholders, including the pharmaceutical industry, would enable proactive action.

This study had some limitations. It was a descriptive study based on data from a single hospital in each country. As such, it described shortages at the facility level, and the data may not be representative of shortages at the national level. In fact, a previous comparison of drug shortages in Canada and France showed that a greater number of shortages were officially reported in Canada than in France at the national level, but the numbers of shortages were similar at the level of individual institutions.[20] During the period of the current study (early 2018), the numbers of drug shortages reported on national drug shortage reporting sites were 2165 in Canada,[39] 827 in Belgium,[40] 261 in Spain,[41] 126 in France,[42] and only 28 in Switzerland.[43] However, these official data should be interpreted with caution because reporting methods vary among these countries. For example, in Belgium, only temporary nonavailability of drugs over 14 days must be declared. In France, the website of the Agence nationale de sécurité des médicaments et des produits de santé reports only shortages of drugs of major therapeutic interest. In Switzerland, reporting of drug shortages is mandatory only for a limited number of critical drugs. In Canada, shortages reported at the drug shortage website theoretically include all known drug shortages; however, declarations are made by the manufacturers themselves, who are free to update the data at any time. In Spain, shortages are declared by health authorities of the autonomous communities (first-level political/administrative divisions within the country's constitutional structure), when detected by these bodies, or by the holders of drug marketing authorizations. However, it is likely that the true number of drug shortages differs among the countries included in this study, regardless of the specified declaration requirements.

Data were collected over a short period (about 1 month). A longitudinal study, extending over a period of at least 1 year, could increase the robustness of the results but would be time-consuming. Nonetheless, participants in the current study considered the reported data as being representative of current practice in their respective institutions. The study did not assess the criticality of identified drug shortages. Not all shortages have the same importance, nor do they carry the same risks for patients; however, each shortage does affect the quality of care, the workload of health care professionals, and the financial burden on the institution. Some previous studies have looked at the clinical consequences of shortages. For example, Stockwell[35] established a link between a shortage of norepinephrine in the United States in 2011 and rates of death from septic shock in relation to the therapeutic alternatives used: across the 27 835 patients in 26 hospitals with a norepinephrine shortage lasting at least 3 months, there was a significant 4% increase in deaths from

septic shock related to shortage of this drug. Drug shortages also have a notable financial impact on health care systems. Alevizakos and others[44] investigated price changes for drugs affected by shortages in the United States between 2005 and 2016 and found a significant increase in prices after a period of shortage. Therefore, drug shortages might have a cascading effect, including price increases and shortages of alternative drugs. The daily management of drug shortages thus requires mobilization of substantial human and financial resources to minimize the impact of shortages on the quality and safety of care.

CONCLUSION

This descriptive study identified a large number of shortages in 1 representative hospital in each of 5 different countries in early 2018. Further studies are required to better describe the current status of drug shortages in these countries. This study highlights the need to focus on this situation, to involve all stakeholders in efforts to prevent and address drug shortages, and to foster international collaboration on this problem.

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ORIGINAL RESEARCH

Knowledge and Attitudes of Hospital Pharmacy Staff in Canada Regarding Medical Assistance in Dying (MAiD)

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ABSTRACT

Background: In February 2015, the Supreme Court of Canada ruled that it was unconstitutional to prohibit physicians from assisting in a patient's consensual death, thereby setting the groundwork for the legalization of medical assistance in dying (MAiD). Much of the research on this topic has focused on physicians, although other health care professionals will be involved in the process, including pharmacists, pharmacy technicians, and pharmacy assistants. In many provinces, the medications required for MAiD will be dispensed from hospital pharmacies, which will result in direct involvement of hospital pharmacy staff.

Objectives: The primary objective was to investigate the knowledge and attitudes of hospital pharmacy staff in Canada regarding MAiD. The secondary objective was to determine the factors that might influence those opinions.

Methods: A 34-question web-based survey was available for 6 weeks during early 2017 to hospital pharmacy staff throughout Canada. For most questions, responses were based on a 5-point Likert scale, ranging from "strongly agree" to "strongly disagree". Descriptive and inferential statistics were used to analyze the data.

Results: A total of 1040 valid survey responses were received: 607 from pharmacists, 273 from pharmacy technicians, and 160 from pharmacy assistants. Most respondents were supportive of MAiD; however, nearly all respondents (99% [601/607] of pharmacists, 73% [315/431] of technicians and assistants]) reported lacking comprehensive education on the topic. Despite high levels of overall support, pharmacists tended to be less supportive of MAiD than pharmacy technicians or assistants. Factors that influenced opinions included strong religious beliefs, region, and knowledge of provincial and federal legislation.

Conclusions: The majority of respondents, particularly technicians and assistants, were supportive of MAiD, but most respondents lacked education about the topic.

Keywords: medical assistance in dying, assisted suicide, hospital pharmacists, pharmacy technicians, pharmacy assistants

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RÉSUMÉ

Contexte : En février 2015, la Cour suprême du Canada a statué qu'il était inconstitutionnel d'interdire aux médecins d'aider les patients à mourir par consentement, ce qui a jeté les bases de la légalisation de l'aide médicale à mourir (AMAM). Une grande partie de la recherche sur le sujet était axée sur les médecins, malgré le fait que d'autres professionnels de la santé seront appelés à participer au processus, notamment les pharmaciens, les techniciens en pharmacie et les aides-pharmaciens. Dans bien des provinces, les médicaments nécessaires à l'AMAM proviendront des pharmacies hospitalières, ce qui résultera en la participation directe du personnel de pharmacie hospitalière.

Objectifs : L'objectif principal visait à examiner les connaissances et l'attitude du personnel de pharmacie hospitalière au Canada relativement à l'AMAM. L'objectif secondaire était de découvrir les facteurs pouvant influencer les avis du personnel sur le sujet.

Méthodes : Pendant six semaines, au début de 2017, un sondage en ligne de 34 questions était à la disposition du personnel de pharmacie hospitalière de partout au Canada. Inspirés de l'échelle de Likert à cinq points, les choix de réponse à la plupart des questions s'étendaient de « fortement d'accord » à « fortement en désaccord ». Des statistiques descriptives et par inférence ont servi à analyser les données.

Résultats : Des 1040 réponses valables, 607 provenaient de pharmaciens, 273 de techniciens en pharmacie et 160 d'aides-pharmaciens. La plupart des répondants étaient en faveur de l'AMAM. Cependant, près de l'ensemble des répondants (99 % [601/607] des pharmaciens et 73 % [315/431] des techniciens et des aides) ont signalé ne pas posséder une connaissance suffisante du sujet. Malgré le degré élevé de soutien apporté par l'ensemble des personnes interrogées, l'appui des pharmaciens à l'AMAM tendait à être plus faible que celui des techniciens en pharmacie ou des aides-pharmaciens. Parmi les facteurs propres à influencer les avis des répondants, on trouvait les croyances religieuses fortes, la provenance géographique et la connaissance des lois provinciales et fédérales.

Conclusions : La majorité des répondants, particulièrement les techniciens et les aides, était en faveur de l'AMAM, mais la plupart des répondants ne possédaient pas une connaissance suffisante du sujet.

Mots clés : aide médicale à mourir, suicide assisté, pharmaciens d'hôpitaux, techniciens en pharmacie, aides-pharmaciens

INTRODUCTION

On February 6, 2015, the Supreme Court of Canada released its judgment in the case of *Carter* v. *Canada (Attorney General)*, specifying that any person who has a "grievous and irremediable medical condition (including an illness, disease, or disability)"[1] has the right to pursue medical assistance in dying (MAiD). Those requesting MAiD must be competent adults who have clearly consented to the termination of life, and whose condition must cause enduring, intolerable suffering.[1]

Switzerland was the first country to decriminalize assistance in suicide (in 1942).[2] Euthanasia or physician-assisted suicide is currently also legal in the Netherlands, Belgium, Luxembourg, Colombia, and several US states (Oregon, Washington, Montana, Vermont, and California).[3] Euthanasia involves a person (usually a physician) actively and intentionally terminating a patient's life by some medical means such as an injection[4] and has been legal in the province of Quebec since 2014.[5] Physician-assisted suicide occurs when physicians prescribe lethal drugs at a patient's request, with the drugs being self-administered.[3] MAiD in Canada encompasses both euthanasia and physician-assisted suicide and is carried out at the request of the patient, after strict criteria have been met (e.g., informed consent, intolerable suffering, and irremediable medical condition). It is up to the patient, the patient's family and/or caregivers, and the patient's health care providers to decide on the best option.

The debate about MAiD almost always focuses on the patient and the physician,[6,7] and little attention has been paid to the perspectives and experiences of other health care professionals who may be actively involved in the process. Pharmacists and pharmacy technicians/assistants will likely be dispensing prescriptions for use in MAiD, with pharmacists also counselling patients and families about these prescriptions.[7] Moreover, in many jurisdictions (including the Northwest Territories, the Yukon, and New Brunswick), the medications required for MAiD are provided by hospital pharmacies, whether the medications are to be administered at a hospital or in the home.[8] The medications involved may vary but usually include a benzodiazepine, a local anesthetic, a coma-inducing agent, and a neuromuscular blocker.[9] Given expansion of the role of pharmacists from purely dispensing products to medication counselling and accepting responsibilities for the outcome of treatment with medications, the issue of MAiD is particularly salient for the profession of pharmacy.[6,10]

Several previous pharmacist surveys regarding MAiD were identified.[7,8,11-17] Four studies considered hospital pharmacists,[8,11,15,16] and only 2 included pharmacy technicians or assistants.[8,16] Lau and others[15] distributed one survey to community pharmacists and a different survey to hospital pharmacists. The survey intended for community pharmacists focused on attitudes and beliefs, whereas the survey distributed to hospital pharmacists had no questions regarding personal opinions, and instead was intended to investigate the presence of hospital guidelines for MAiD.

Hackett and Francis[11] distributed a survey to both hospital and community pharmacists in the United Kingdom, and found that community pharmacists were significantly less likely than hospital pharmacists to want to know the intended purpose of medications for assisted dying. (It should be noted that MAiD was illegal in Britain at that time, and remains so today.) These researchers hypothesized that the opinions of hospital pharmacists might differ from those of community pharmacists because hospital pharmacists are likely to have greater access to patient information (e.g., diagnosis, age, comorbidities, medical history) than community pharmacists.[11] Additionally, community pharmacists are less likely than hospital pharmacists to have frequent and direct contact with the prescriber.[11] Hanlon and others[7] also speculated that hospital pharmacists are more likely to have contact with terminally ill patients and that those experiences may have an effect on their opinions on the topic of MAiD.

A survey by the Canadian Pharmacists Association (CPhA) included both community and hospital pharmacists, as well as technicians.[16] However, most respondents (more than 70%) worked in the community, and only 1% of respondents were pharmacy technicians. That survey focused on freedom of conscience and the legislation, rather than the beliefs and attitudes of pharmacy professionals. A more recent survey, by Murphy and others,[17] involved community pharmacists' attitudes toward suicide and their professional experiences with people at risk of suicide. The recently published study by Verweel and others[8] compared legislation across Canada and also surveyed members of the Ontario Pharmacists Association (i.e., pharmacists, technicians, and students). It identified a variety of concerns, including issues related to dispensing medications and answering inquiries about MAiD.[8]

In light of the relative lack of information about the views of Canadian hospital pharmacy staff regarding MAiD, the purpose of the present study was to determine the current knowledge and attitudes of hospital pharmacy staff in Canada regarding MAiD and to identify specific factors affecting these attitudes. We hypothesized that pharmacy staff reporting that their religious beliefs influenced their professional work would be less supportive of MAiD[7,11,12,15] and that pharmacy staff who had frequent interactions with terminally ill patients and/or had worked in palliative care or oncology would be more supportive of MAiD.[12] On the basis of previous results, we expected that a majority of those surveyed would report needing more training in the area of MAiD, particularly in terms of what drugs should be used and how to counsel patients and their families.[8,16] We also compared responses provided by pharmacists with responses provided by a combined group of pharmacy technicians and assistants, to examine differences between these 2 groups.

METHODS

An online software tool, FluidSurveys, was used to distribute a 34-question web-based anonymous survey to hospital pharmacy

staff throughout Canada. The survey was available in both French and English for 6 weeks between January and March 2017. The survey questions were developed by the research team, with some questions being adapted (with permission) from previous surveys.[7,12,18] During development of the survey, a focus group of pharmacists and pharmacy technicians/assistants at the authors' site was used to assess the clarity of the questions and the face validity of the instrument.

Preliminary questions addressed demographic status and work experiences (e.g., amount of time spent in direct patient care and amount of interaction with patients with end-stage disease or disability). In the main section of the survey, the first group of 4 items (concerning MAiD education) addressed the amount of MAiD-related education that the respondent had received, with answers ranging from "nothing at all" to "comprehensive education". The second group of 4 items (concerning values) measured level of agreement with the general notion of MAiD, and the third set of 5 items (concerning reluctance) asked about personal willingness to carry out tasks related to MAiD. The questions for these groups of items are available in Box 1. For the latter 2 sets of items, Likert scales ranging from 1 (strongly agree) to 5 (strongly disagree) were used, such that a higher score indicated opposition to MAiD. Next, respondents were asked to rate the eligibility criteria for MAiD (8 items) laid out by the government of Canada[19] on a scale ranging from 1 (not important) to 5 (very important). The fifth set of 3 questions addressed self-reported level of knowledge about federal, provincial, and institutional legislation and guidelines regarding MAiD. Lastly, respondents were asked how influential their religious beliefs were on their work in relation to MAiD (on a scale ranging from 1 [not important at all] to 7 [absolutely essential]), with the option of answering "not applicable". In a second question in this part of the survey, respondents were asked what guidance their religious affiliation provided regarding MAiD, on a scale ranging from 1 (permits MAiD) to 7 (does not permit MAiD).

Box 1. Statements Regarding Medical Assistance in Dying (MAiD) Included in a Survey of Hospital Pharmacy Staff*

Values

In my opinion, a dying patient has the right to end his or her life.

In my opinion, a patient has the right to end his or her life with the assistance of medical professionals.

In my opinion, it is appropriate for MAiD to be accomplished through the use of prescription medications.

If a pharmacist refuses to be involved in MAiD, it is his or her responsibility to refer the patient/other health care professional to a pharmacist willing to be involved in the process.

Reluctance

I am willing to participate in the procurement, preparation, and dispensing of medications for use in MAiD.

I would knowingly participate in the dispensing of a prescription for use in MAiD.

It is appropriate for a pharmacist or pharmacy technician/assistant to refuse to dispense a prescription if they know it will be used for MAiD.†

As part of the health care team, I am willing to participate in deciding if a patient meets eligibility criteria for MAiD.‡

I am willing to counsel patients and their family on medications prescribed for use in MAiD.‡

*Responses were based on a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree), where a higher score indicated opposition to MAiD.
†This item was reverse-coded.
‡Question that appeared only on the survey for pharmacists because this aspect is beyond the scope of practice of technicians and assistants.

Participants

An invitation to participate in the survey was distributed to hospital pharmacies across Canada through provincial and territorial pharmacy regulatory bodies, pharmacists' associations, pharmacy directors, the Canadian Society of Hospital Pharmacists, and the Association des pharmaciens des établissements de santé du Quebec. One reminder email was sent to all parties at the halfway point of data collection.

The research protocol was reviewed and approved by 2 research ethics board (from the home institutions of the coauthors) in December 2016. Participants read a cover letter describing the study, and indicated informed consent by completing the anonymous survey. Respondents who identified their primary area of practice as community pharmacy or some other nonhospital setting were excluded from the study.

Statistical Analyses

Descriptive statistics, including means and standard deviations, were used to describe the respondents' demographic information. For questions with Likert-scale responses, a 1-sample *t* test was used to determine whether the group mean was significantly different from the midpoint on the scale. Inferential statistics (*t* tests and analysis of variance) were used to compare pharmacists and a combined group of pharmacy technicians and pharmacy assistants (referred to hereafter as "technicians/assistants") in terms of their knowledge and attitudes regarding MAiD. When multiple *t* tests were used, a Bonferroni correction was applied to control for family-wise α inflation. Namely, the critical *p* value used to establish statistical significance was calculated as 0.05 divided by the number of items in each section of the survey. Parallel nonparametric tests (Wilcoxon and Mann-Whitney *U* tests) were carried out when normality assumptions were not met, but all results remained the same, and therefore the results of parametric inferential tests are reported. Means, standard deviations (SDs), medians, and interquartile ranges (IQRs) are reported where relevant. Pearson and point-biserial correlations were used to investigate the relationships between pharmacist and technician/assistant characteristics and responses to questions

about values regarding MAiD and reluctance to carry out MAiD. Parallel nonparametric Spearman correlations were calculated, and differences in results obtained are noted. All analyses were carried out using IBM-SPSS version 22.0 software (IBM, Armonk, New York).

RESULTS

A total of 1040 valid survey responses were received (Figure 1). The respondents consisted of 607 pharmacists, 273 pharmacy technicians, and 160 pharmacy assistants. It was not possible to determine the response rate in relation to the number of pharmacists and technicians/assistants working in Canadian hospitals. Currently, the Alberta College of Pharmacists does not provide detailed statistics to the National Association of Pharmacy Regulatory Authorities, submitting only the total number of licensed pharmacists and technicians. It was therefore not possible to determine the total number of pharmacists and technicians practising in the hospital setting in Canada. Pharmacy assistants are not regulated, and therefore the total number of practising assistants was unavailable.[20] Given the similarities in many of the functions performed in hospital pharmacy practice by technicians and assistants, the results of their responses were combined for further analysis. The responses represented all 10 provinces and 1 territory. Demographic information is presented in Table 1.

In terms of professional experience, pharmacists reported spending more time in direct patient care than did technicians/assistants ($t(1028.83) = 17.22$, $p < 0.001$). Whereas the modal response for pharmacists was 75%–100% of time spent in direct patient care (mean 2.8 [SD 1.2] on 4-point scale), the technicians/assistants had a modal response of 0%–25% of the time (mean 1.5 [SD 0.9] on 4-point scale). Pharmacists also reported having had more interactions with patients with end-stage disease ($t(1024.10) = 20.33$, $p < 0.001$). Whereas the modal response for pharmacists ($n = 195/606$ or 32% of the sample) was "occasionally" (mean 3.0 [SD 1.3] on 5-point scale), the modal response for technicians/assistants ($n = 300/429$ or 70% of the sample) was "very rarely" (mean 4.4 [SD 1.0] on 5-point scale).

MAiD Education

The majority of pharmacists reported having received little to no education regarding MAiD during their formal pharmacy education (601/607, 99%) or through continuing education (453/607, 75%). Similarly, the majority of respondents in the technician/assistant group reported having received little to no MAiD education during their formal pharmacy training (315/431, 73%) or continuing education (366/422, 87%). Whereas 28% ($n = 171/606$) of pharmacists reported seeking out self-directed learning on the topic, only 17% ($n = 74/423$) of technicians/assistants had done so. When asked where education on MAiD should occur, the most frequent response from pharmacists (376/604, 62%) was during the entry-to-practice degree, and the most frequent response for technicians/assistants (215/431, 50%) was through formal continuing education. One-sample t tests showed that, for both groups of respondents,

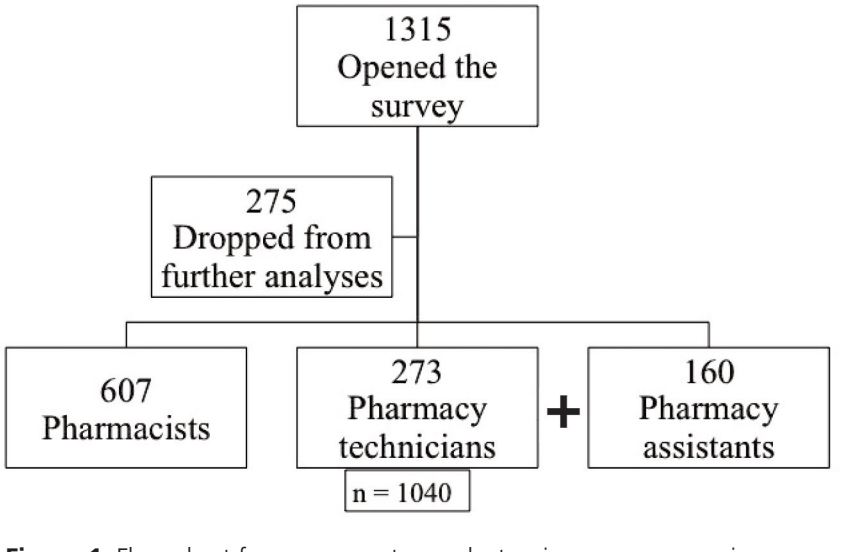

Figure 1. Flow chart for responses to an electronic survey concerning knowledge and attitudes of hospital pharmacy staff members regarding medical assistance in dying. Data for respondents who did not complete any questions, who did not complete the majority of questions, or were ineligible because they worked in community pharmacy (totalling 275) were omitted from further analysis.

Table 1. Demographic Characteristics of Hospital Pharmacy Respondents to a Survey Regarding Medical Assistance in Dying

Characteristic	No. (%) of Respondents*		*p* Value
	Pharmacists (*n* = 607)	Technicians/ Assistants (*n* = 433)	
Sex			< 0.001‡
Male	155 (26)	26 (6)	
Female	452 (74)	407 (94)	
Age (years)	*n* = 589	*n* = 422	
Mean ± SD	39.66 ± 10.63	38.77 ± 10.45	0.19†
Time in practice (years)	*n* = 601	*n* = 431	
Mean ± SD	15.33 ± 11.01	14.41 ± 9.51	0.15†
Education	*n* = 607	*n* = 433	–
Bachelor of Pharmacy	515 (85)	NA	
CCAP-accredited technician course	NA	236 (55)	
Position	*n* = 605	*n* = 433	–
Staff pharmacist	467 (77)	NA	
Product preparation/dispensary	NA	266 (61)	
Geographic location	*n* = 607	*n* = 433	< 0.001‡
Alberta, British Columbia, Yukon	227 (37)	215 (50)	
Saskatchewan, Manitoba	119 (20)	50 (12)	
Ontario, Quebec	120 (20)	75 (17)	
Atlantic provinces	141 (23)	93 (21)	
Time spent in direct patient care	*n* = 606	*n* = 432	< 0.001‡
< 50%	264 (44)	367 (85)	
≥ 50%	342 (56)	65 (15)	
No. of beds in workplace	*n* = 605	*n* = 432	0.01‡
≤ 200	172 (28)	147 (34)	
> 200	433 (72)	285 (66)	
Current practice area	*n* = 603	*n* = 431	–
Oncology/hematology	54 (9)	33 (8)	
Palliative care	11 (2)	2 (<1)	
Other	538 (89)	396 (92)	
Previous practice area	*n* = 607	*n* = 433	–
Oncology/hematology	114 (19)	72 (17)	
Palliative care	76 (12)	19 (4)	
No previous practice in oncology/ hematology or palliative care	417 (69)	342 (79)	
Institutional policy permitting MAiD	*n* = 595 460 (77)	*n* = 423 266 (63)	–

CCAP = Canadian Council for Accreditation of Pharmacy Programs,
MAiD = medical assistance in dying, NA = not applicable, SD = standard deviation.
*Except when indicated otherwise.
†By *t* test.
‡By χ^2 test.

the average ratings for MAiD education were significantly lower than the midpoint of the scale, which implied that respondents felt they did not have much education on the topic.

Values

Both groups were very supportive of MAiD in terms of values (Figure 2). One-sample *t* tests showed that means were significantly different from the neutral response on the scale, in the direction indicating that respondents were supportive of MAiD. However, the pharmacist and technician/assistant groups differed significantly on several questions regarding their attitudes toward MAiD. The pharmacists were significantly more likely to disagree with the notion that patients have the right to end their own life ($t(1038) = 4.31$, $p < 0.001$), the belief that patients have the right to end their life with the assistance of medical professionals ($t(1018.99) = 5.46$, $p < 0.001$), and the belief that it is appropriate for MAiD to be accomplished through the use of prescription medications ($t(1038) = 4.26$, $p < 0.001$). Pharmacists and technicians/assistants responded similarly when asked whether a pharmacy provider who refuses to be involved in MAiD is responsible for referring the patient to another professional

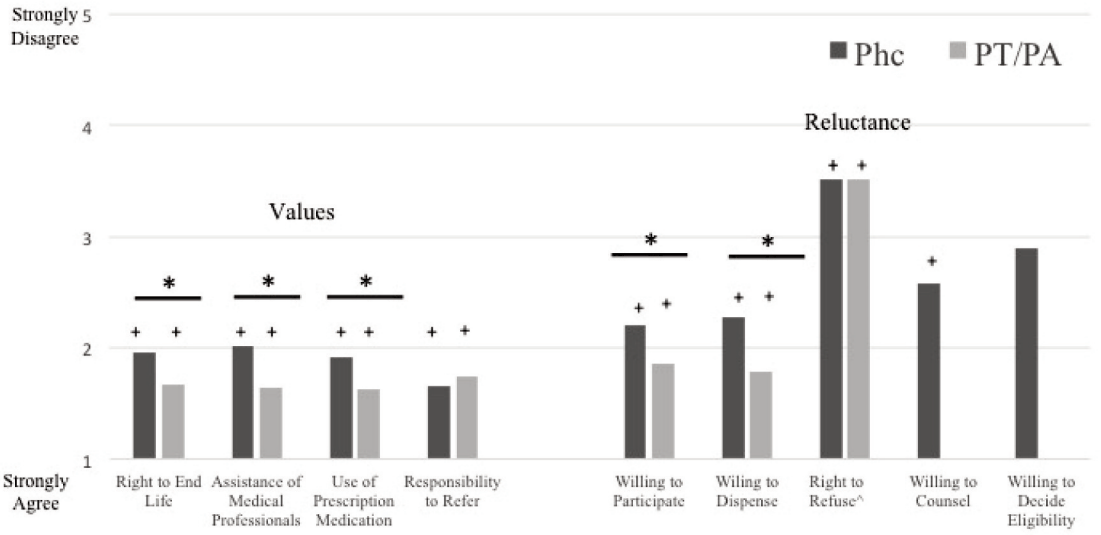

Figure 2. Mean level of agreement with each statement. For all variables, a lower score indicates greater support for medical assistance in dying. Data for responses on the right to refuse (flagged with a caret symbol, ^) were reverse-coded. Data marked with an asterisk (*) remained significant with the Bonferroni correction. Values marked with a plus symbol (+) were significantly different from 3.0, the midpoint on the scale. Phc = pharmacists, PT = pharmacy technicians, PA = pharmacy assistants.

willing to be involved in the process. Comparisons between pharmacists and technicians/assistants in terms of levels of agreement with each value statement are presented in Table 2.

Reluctance

Overall, both groups were very supportive of MAiD in terms of factors related to reluctance (Figure 2). For both groups, most average responses were significantly different from the midpoint of the scale (in the direction showing support for MAiD), as indicated by 1-sample *t* tests. Respondents were asked to rate their own personal willingness to provide MAiD services. Relative to technicians/assistants, pharmacists were less willing to knowingly participate in dispensing a prescription for use in MAiD ($t(105.64) = 4.50$, $p < 0.001$) and less willing to participate in the

Table 2. Responses across Questionnaire Items*

Item	Professional Group; No. (%) Agreeing†		Professional Group; No. (%) Disagreeing‡	
	Pharmacists (*n* = 607)	Technicians/ Assistants (*n* = 433)	Pharmacists (*n* = 607)	Technicians/ Assistants (n = 433)
Values				
Right to end life	474 (78)	364 (84)	68 (11)	25 (6)
Assistance of medical professionals	471 (78)	370 (85)	83 (14)	26 (6)
Use of prescription medication for MAiD	496 (82)	368 (85)	78 (13)	24 (6)
Responsibility to refer	537 (88)	360 (83)	48 (8)	39 (9)
Reluctance				
Willing to participate	437 (72)	345 (80)	119 (20)	47 (11)
Willing to dispense	426 (70)	345 (80)	121 (20)	38 (9)
Right to refuse	360 (59)	243 (56)	146 (24)	112 (26)
Willing to counsel§	353 (58)	NA	155 (26)	NA
Willing to decide eligibility§	273 (45)	NA	211 (35)	NA

NA = not applicable.
*Respondents used a 5-point Likert scale; data for the neutral response (3) are not reported in this table.
†Combined responses of 1 (strongly agree) and 2 (agree).
‡Combined responses of 5 (strongly disagree) and 4 (disagree).
§Responses were solicited from pharmacists only, because counselling and deciding eligibility are beyond the scope of practice of technicians and assistants.

procurement, preparation, and dispensing of medications for use in MAiD ($t(1017.21) = 6.38$, $p < 0.001$). The groups did not differ significantly in terms of their views of whether it is appropriate for a pharmacist or technician/assistant to refuse to dispense a prescription if it is known that the medication will be used for MAiD ($t(871.55) = 0.01$, $p = 0.99$). Respondents were asked whether they wished to be told if a prescription they were dispensing would be used for MAiD: 87% ($n = 531/607$) of pharmacists and 54% ($n = 233/430$) of technicians/assistants said yes ($\chi^2(2, N = 1037) = 144.16$, $p < 0.001$). When asked if they had ever dispensed a prescription for MAiD after it became legal, 18% ($n = 107$) of pharmacists were sure they had, and 78% ($n = 471$) were sure they had not, whereas 15% ($n = 63$) of technicians/assistants were sure they had, and 58% ($n = 249$) were sure they had not. The remaining respondents were unsure. A χ^2 test showed that the 2 professions did not differ significantly on this variable ($\chi^2(1, N = 1037) = 1.15$, $p = 0.28$). Finally, pharmacists were significantly more willing to provide counselling to patients regarding medications used for MAiD (mean 2.6 [SD 1.3]) than to participate in determining eligibility for MAiD (mean 2.9 [SD 1.3]) ($t(606) = 7.52$, $p < 0.001$) (Figure 2).

Eligibility

Respondents were asked to rate the importance of each eligibility criterion as defined by the government of Canada.[19] Pharmacists rated the criterion of "clear consent to MAiD" as being significantly more important than did technicians/assistants ($t(766.4) = 2.83$, $p = 0.003$). The 2 groups did not differ significantly on the other criteria. All of the criteria were rated quite highly by both groups, and the groups generally agreed on which criteria were most important. When the 2 groups were combined, lowest importance was given to "age over 18" (mean 3.8 [SD 1.2], median 4 [IQR 2] on 5-point scale) and highest importance to "clear consent" and "no outside pressure" (for both criteria, mean 4.8 [SD 0.7], median 5 [IQR 0] on 5-point scale). Descriptive information for these scores is provided in Table 3.

Knowledge

Pharmacists (mean 2.7 [SD 1.2] and median 3 [IQR 2] on 5-point scale, where lower scores indicate more knowledge) reported being more informed of federal legislation regarding MAiD than did technicians/assistants (mean 3.0 [SD 1.2] and median 3 [IQR 2] on 5-point scale) ($t(1038) = 3.35$, $p = 0.001$). Similar results were obtained for knowledge of provincial legislation (for pharmacists, mean 2.7 [SD 1.1], median 3 [IQR 2]; for technicians/assistants, mean 3.0 [SD1.2], median 3 [IQR 2]; $t(1038) = 3.1$, $p = 0.002$). When asked whether they knew of their hospitals' policies regarding MAiD, the majority of both pharmacists (460/595, 77%) and technicians/assistants (266/423, 63%) reported working at hospitals that permitted MAiD. A larger percentage of technicians/assistants (133/423, 31%) than pharmacists (82/595, 14%) did not know whether their respective hospitals had a policy regarding MAiD ($\chi^2(1, N = 1018) = 46.29$, $p < 0.001$).

Religious Influence

Two items on the questionnaire (based on a 7-point scale) addressed religious views. Results indicated that pharmacists (mean 3.1 [SD 2.3] and median 2 [IQR 4]) considered religion to have a stronger influence on their professional work than did technicians/assistants (mean 2.6 [SD 2.2] and median 1 [IQR 3]) ($t(713.8) = 2.6$, $p = 0.01$). However, 15 pharmacists did not answer this question, and a further 107 pharmacists answered "not applicable"; these 122 individuals (20%) were excluded from the analysis. Similarly, 8 technicians/assistants did not answer this question, and a further 99 technicians/assistants answered "not applicable"; these 107 individuals (25%) were also excluded from these analyses. Pharmacists (mean 5.0 [SD 2.5] and median 6 [IQR 5]) were more likely than technicians/assistants (mean 4.2 [SD 2.7] and median 4 [IQR 6]) to report that their religious affiliation had negative views regarding MAiD ($t(376.9) = 3.19$, $p = 0.002$). For this variable, 23 pharmacists did not answer the question, and a further 288 pharmacists answered "not applicable";

Table 3. Views on Eligibility Criteria for MAiD

Criterion	Professional Group; % Rating Criterion as Moderately or Very Important		Professional Group; Mean Score* ± SD	
	Pharmacists	Technicians/ Assistants	Pharmacists	Technicians/ Assistants
Age ≥ 18 years	70	60	3.9 ± 1.1	3.7 ± 1.3
Mental competency	90	86	4.6 ± 0.8	4.5 ± 0.8
Grievous medical condition	90	85	4.6 ± 0.8	4.5 ± 0.9
Irremediable medical condition	88	84	4.5 ± 0.8	4.4 ± 1.0
Intolerable suffering	90	87	4.6 ± 0.8	4.6 ± 0.9
Reasonably foreseeable death	81	80	4.3 ± 1.0	4.3 ± 1.1
Clear consent to MaiD†	94	90	4.8 ± 0.6	4.7 ± 0.8
No outside pressure or influence	93	90	4.8 ± 0.6	4.7 ± 0.8

MaiD = medical assistance in dying, SD = standard deviation.
*The scale ranged from 1 (not at all important) to 5 (very important).
†The 2 groups were significantly different, at $p < 0.006$ (Bonferonni correction).

Table 4. Relationships between Respondent Characteristics (Demographic and Work Variables) and Outcome Variables for Pharmacists, Using Point-Biserial Correlations for Binary Variables and Pearson Correlations for Continuous Variables*

Characteristic	Values				Reluctance				
	Right to End Life	Assistance of Medical Professionals	Use of Prescription Meds	Responsibility to Refer	Willing to Participate	Willing to Dispense	Right to Refuse	Willing to Counsel	Willing to Decide Eligibility
Respondent characteristics									
Age	0.10	0.10	0.08	0.10	0.06	0.01	–0.04	0.06	–0.001
Sex†	–0.06	–0.06	–0.06	–0.05	–0.05	–0.02	–0.02	0.03	–0.01
Religious influence‡	0.67**	0.67**	0.63**	0.34**	0.69**	0.66**	–0.38**	0.55**	0.42**
Religion and MAiD§	0.41**	0.42**	0.39**	0.13	0.41**	0.40**	–0.29**	0.30**	0.28**
Professional characteristics									
Size of hospital	–0.01	–0.02	–0.02	–0.03	–0.01	–0.03	–0.08	0.004	–0.03
Direct patient care	–0.01	0.02	0.01	0.05	0.03	0.06	–0.04	–0.05	–0.04
End-stage care	–0.01	–0.03	–0.02	–0.02	–0.03	–0.05	–0.01	0.07	0.06
Practice area¶	–0.01	–0.003	–0.02	0.04	0.01	–0.03	–0.01	–0.03	0.03
Policy									
Knowledge of legislation	0.10††	0.12**	0.15**	0.13**	0.19**	0.22**	0.07	0.16**	0.15**
Hospital policy	–0.04	–0.05	–0.03	–0.06	–0.02	0.02	0.08	–0.09	–0.11

MAiD = medical assistance in dying.
*For all outcome variables, higher values indicate opposition to MAiD. Using the Bonferroni correction, the critical *p* value for significance was 0.005. Because of missing data, the sample size ranged from 571 to 607, except for religious influence on work (*n* = 485) and religion and MAiD (*n* = 296). Participants who chose "not applicable" on the latter 2 variables were excluded from the analyses.
†Men were coded as 1 and women as 2.
‡Higher scores indicate more religious influence on views toward MAiD.
§Higher scores indicate more negativity regarding MAiD by religious affiliation.
¶For practice area, working or having worked in palliative care/oncology was coded as 1, and never having worked in these areas was coded as 0.
**Correlation was significant using both the Spearman (nonparametric) and the Pearson (parametric) correlations.
††Correlation was significant using the Spearman (nonparametric) correlation, but nonsignificant using the Pearson (parametric) correlation.

these 311 individuals (51%) were excluded from the analysis. Similarly, 16 technicians/assistants did not answer this question, and a further 227 technicians/assistants answered "not applicable"; these 243 individuals (56%) were also excluded from the analysis.

Predicting Scores

The relationships between respondent characteristics (demographic and work variables) and outcome variables are shown in Tables 4 and 5, using point-biserial correlations for binary variables and Pearson correlations for continuous variables. The results of these analyses indicated that both pharmacists and technicians/assistants with stronger religious beliefs and those whose religious affiliations reject MAiD were less supportive of MAiD. Generally, professional characteristics were not strong predictors, and individuals who were better informed about provincial and federal legislation were more supportive of MAiD. Finally, technician/assistant respondents who reported working at hospitals that permitted MAiD were also more supportive of MAiD. Given that many respondents reported "not applicable" when asked to rate the importance of religion to their professional work, religiosity was further explored by creating one group of individuals for whom religion was somewhat or very important, and comparing their views on religion to the rest of the sample. The latter group was made up of individuals who chose "not applicable" and those who reported that their religious views did not influence their work regarding MAiD. For both pharmacists and technicians/assistants, the group with a higher level of religiosity had significantly more negative views regarding MAiD ($p < 0.001$) in terms of each of the values and reluctance variables.

For some outcomes, region was also important. When pharmacists in the 4 regions of the country were compared, significant results were obtained for willingness to participate in MAiD ($F(3,603) = 4.30$, $p = 0.005$), right to refuse ($F(3,603) = 5.36$, $p = 001$), and willingness to provide counselling ($F(3,603) = 4.38$, $p = 0.005$). Post hoc tests indicated that pharmacists in the western part of the country (Alberta, British Columbia, Yukon) were less willing to participate than those in central Canada (Quebec, Ontario) and the Atlantic provinces (New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador), were more likely than those in the Prairie provinces (Saskatchewan and Manitoba) to agree that a pharmacist should be able to refuse to dispense MAiD medications, and were less willing than pharmacists in central Canada to provide counselling about MAiD medications.

When technician/assistant respondents from different regions were compared, the only significant result related to the appropriateness of refusing to fill out a prescription for use in MAiD ($F(3,429) = 5.0$, $p = 0.002$). For this variable, respondents in the western region (Alberta, British Columbia, Yukon) were less supportive of MAiD than those in central Canada (Quebec, Ontario).

Table 5. Relationships between Respondent Characteristics and Outcome Variables for Pharmacy Technicians and Assistants, Using Point-Biserial Correlations for Binary Variables and Pearson Correlations for Continuous Variables*

Characteristic	Values				Reluctance		
	Right to End Life	Assistance of Medical Professionals	Use of Prescription Medications	Responsibility to Refer	Willing to Participate	Willing to Dispense	Right to Refuse
Respondent characteristics							
Age	–0.01	–0.03	–0.03	0.12	0.01	–0.01	0.07
Sex†	–0.12	–0.14††	–0.13	–0.09	–0.09	–0.13	0.03
Religious influence‡	0.56**	0.55**	0.53**	0.21**	0.55**	0.55**	–0.25**
Religion and MAiD§	0.33**	0.31**	0.29**	0.04	0.32**	0.31**	–0.17
Professional characteristics							
Size of hospital	–0.06	–0.06	–0.03	–0.02	–0.04	–0.06	0.13‡‡
Direct patient care	–0.09	–0.13	–0.09	–0.07	–0.12	–0.11	0.10
End-stage care	0.06	0.11	0.09	0.09	0.08	0.08	–0.10
Practice area¶	–0.10	–0.10	–0.08	–0.08	–0.04	–0.04	0.08
Policy							
Knowledge of legislation	0.23**	0.24**	0.26**	0.09‡‡	0.21**	0.21**	0.14**
Hospital policy	0.16**	0.16**	0.16**	0.08	0.18**	0.16**	0.16**

MaiD = medical assistance in dying.
*For all outcome variables, higher values indicate opposition to MAiD. Using the Bonferroni correction, the critical *p* value for significance was 0.005. Because of missing data, the sample size ranged from 418 to 433, except for religious influence on work (*n* = 326) and religion and MAiD (*n* = 190). Participants who chose "not applicable" on the latter 2 variables were excluded from the analyses.
†Men were coded as 1 and women as 2.
‡Higher scores indicate more religious influence on views toward MAiD.
§Higher scores indicate more negativity regarding MAiD by religious affiliation.
¶For practice area, working or having worked in palliative care/oncology was coded as 1, and never having worked in these areas was coded as 0.
**Correlation was significant using both the Spearman (nonparametric) and the Pearson (parametric) correlations.
††Correlation was significant using the Pearson (parametric) correlation, but nonsignificant using the Spearman (nonparametric) correlation.
‡‡Correlation was significant using the Spearman (nonparametric) correlation, but nonsignificant using the Pearson (parametric) correlation.

DISCUSSION

The goals of the study were to investigate the attitudes and self-rated knowledge of hospital pharmacy staff regarding MAiD and to identify predictors of these attitudes, for both pharmacists and pharmacy technicians and assistants. Few published studies have considered the knowledge and attitudes of hospital pharmacy technicians and pharmacy assistants regarding MAiD in Canada. Overall, both pharmacists and pharmacy technicians and assistants working in the hospital setting were very supportive of MAiD, a finding that was also reported by Verweel and others,[8] who surveyed hospital and community pharmacists and technicians who were members of the Ontario Pharmacists Association. In the present study, respondents rated all MAiD eligibility criteria as very important. Generally, technicians and assistants who responded to this survey were more supportive of MAiD than their pharmacist counterparts. Furthermore, they were more willing to knowingly dispense medications for MAiD. It is difficult to determine why technicians and assistants had a more supportive opinion of MAiD than pharmacists. It is possible that technicians and assistants have less direct contact with patients and families, which thereby affords them a more objective view. However, percentage of time spent in direct patient care was not a significant predictor of values or reluctance. Another possibility is that pharmacists' more extensive knowledge of therapeutic options to manage palliative symptoms lessens the likelihood of considering death as the best option for patients who qualify for MAiD. Although we combined pharmacy technicians and assistants in the present study, education and professional duties differ between these groups, and these factors may affect their views on MAiD and other topics. Researchers may want to explore these potential differences in future studies.

We hypothesized that pharmacy staff with strong religious beliefs would be less supportive of MAiD, as has been found in several previous surveys.[7,11,12,15] In the present study, the strongest predictors of attitudes toward MAiD were religious in nature. Interestingly, a large number of the respondents to this survey indicated that their religious beliefs did not affect their professional work related to MAiD, and, on average, these individuals were more supportive of MAiD than pharmacy staff who reported that their religious beliefs influenced their work.

We also found that pharmacy staff in the western part of the country (Alberta, British Columbia, Yukon) tended to be less supportive of MAiD. This unexpected finding requires replication for confirmation and may merit further research. One possibility is that the training programs in different parts of the country differ in terms of the views about MAiD that are inculcated in students. Pursuing this question would require linking practising pharmacists with their respective programs of study, which was not possible with the present data set. This finding could also reflect differences in the palliative care services available in different regions, which may affect attitudes regarding MAiD. MAiD has been legal in Quebec since 2014, which may partially account for respondents in central Canada (Quebec, Ontario) appearing more willing to be involved in the process than pharmacy staff in the west.

Furthermore, we hypothesized that pharmacy staff who had frequent interactions with terminally ill patients and/or had worked in palliative care or oncology would be more supportive of MAiD, as was demonstrated by the Rupp and Isenhower survey.[12] This hypothesis was not supported by the results of our survey: pharmacists and technicians/assistants who worked or had worked in palliative care and oncology did not have significantly different opinions from those who worked in other areas. However, only about 10% of respondents were working in palliative care or oncology/hematology at the time of the survey. This sample may have been too small to allow a significant difference to be found, if such a difference had existed. It would be interesting to pursue this question by carrying out a further survey with this specific population.

A novel finding in the present study was the importance of knowledge about MAiD legislation as a predictor of support for the practice. Similar to the CPhA survey[16] and the survey completed by Verweel and others,[8] the majority of respondents to our survey felt they lacked comprehensive education on the topic. We propose here that formal pharmacy education for both technicians and pharmacists should include MAiD, as it is likely to be encountered at some point in their future careers. At the time of this survey, MAiD had been legal in Canada for only 8 months, yet already one-third of respondents had dispensed a prescription for its use. The results of this survey suggest that the preferred format for education regarding MAiD would be during undergraduate training for pharmacists and through continuing education for pharmacy technicians/assistants. In the present study, people who were more knowledgeable about MAiD legislation were also more supportive of it. However, the directionality of this relationship is not clear: Does support of MAiD lead professionals to read the legislation, or does reading the legislation lead to positive views? The survey also did not address the influence of position statements drafted or published by various pharmacy professional or other health care organizations. To address these questions, it may be interesting to repeat this survey in 5 to 10 years. It is possible that pharmacy staff will become even more supportive of MAiD as they learn more about the process and have more experience with it.

It appears that the future of health care in Canada will include MAiD as one aspect of autonomy for patients who meet the criteria. This study has demonstrated that the majority of pharmacy staff members are willing to be involved in this new practice and to aid in granting these patients their final wish. However, this research (along with 2 other studies[8,16]) reveals that pharmacy staff feel they are lacking education on the topic. Additionally, it appears that as people become more educated on the topic, their support increases.

Strengths and Limitations

This study had several strengths, including its large sample size encompassing pharmacy staff across Canada. This study was also one of the first to survey hospital pharmacy technicians and assistants on this timely and important topic. Unfortunately, it was impossible to reach all hospital pharmacy staff in Canada because of various anti-spam regulations; therefore, the regions of the country may not all have been represented to the same extent. Additionally, some sampling bias is possible, given that this topic has generated much discussion in workplaces and in society at large, and those with a strong opinion on the subject may have been more likely to respond. In future research projects on this topic, a mixed-methods approach may be helpful to gain a better understanding of the motivation and thoughts behind various responses. Such an approach would also allow an exploration of how attitudes regarding MAiD are influenced by past experiences such as the death of a loved one or particularly harrowing experiences with dying patients.

CONCLUSION

Overall, pharmacy staff across the country who responded to this survey tended to be very supportive of MAiD. Moreover, technicians and assistants who responded to this survey tended to be more supportive of MAiD than pharmacists, including attitudes regarding MAiD and willingness to carry out professional duties related to MAiD. The strongest predictors of supportive attitudes toward MAiD included respondents' knowledge of federal and provincial legislation, as well as the combination of degree of religious faith and the stance of one's faith on MAiD. In conclusion, these findings highlight the importance of education in preparing pharmacy staff to carry out a scope of practice that increasingly includes MAiD across the country.

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Evaluation of Physical Assessment Education for Practising Pharmacists: A Cross-Sectional Survey

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ABSTRACT

Background: Pharmacists are now seeking to incorporate physical assessment (PA) into their practices. This trend prompted the creation, by the British Columbia Branch of the Canadian Society of Hospital Pharmacists, of a 30-h course specifically designed for practising pharmacists.

Objective: To evaluate pharmacists' knowledge, skills, and confidence in performing PA after completing the course.

Methods: All course participants were invited to complete 2 anonymous online surveys, immediately and 6 months after course completion.

Results: Of the 218 participants, 82 (38%) responded to the survey administered immediately after the course, and 77 (35%) completed this survey in full. About half of the respondents (39/79 [49%]) reported use of PA on a real patient before taking the course. Lack of formal training and lack of comfort were the most frequently selected barriers to performing PA. All respondents (79/79) agreed that the course had improved their knowledge of PA, 96% (76/79) agreed that it had improved their skills, and 90% (71/79) agreed that it had improved their ability to care for patients. In addition, 61% (48/79) and 67% (53/79), respectively, agreed that they felt confident performing PA and intervening with regard to a patient's drug therapy on the basis of physical findings. Thirty-eight (17%) of the course participants completed the 6-month follow-up survey. In that survey, the most frequently selected barrier to performing PA was lack of time. Paired data, available for 23 respondents, showed a significant increase in use of PA on real patients over time ($p = 0.013$ by χ^2 test). However, there was no significant improvement in confidence in performing PA or intervening on a patient's drug therapy on the basis of physical findings ($p > 0.05$ by 2-sided t test). The primary limitation of this study was potential responder bias.

Conclusions: A PA course designed for pharmacists improved participants' self-reported knowledge and skills, as well as self-perceived ability to care for patients. Six months after the course, two-thirds of respondents had used PA in practice. However, there was no improvement in confidence in performing such assessments or using the findings to intervene on a patient's drug therapy.

Keywords: physical examination, pharmacists, surveys and questionnaires

RÉSUMÉ

Contexte : Les pharmaciens cherchent désormais à ajouter l'examen physique à leurs pratiques. Cette tendance a motivé la section britanno-colombienne de la Société canadienne des pharmaciens d'hôpitaux à créer un cours de 30 heures conçu spécialement pour les pharmaciens en exercice.

Objectif : Évaluer les connaissances, les compétences et le degré d'aisance des pharmaciens ayant suivi le cours portant sur la réalisation d'examens physiques.

Méthodes : Tous les participants au cours ont été invités à remplir deux sondages anonymes en ligne : l'un à la fin du cours et l'autre six mois après la fin du cours.

Résultats : Des 218 participants, 82 (38 %) ont répondu partiellement au sondage mené immédiatement à la fin du cours et 77 (35 %) y ont répondu en entier. Environ la moitié des répondants (39/79 [49 %]) ont indiqué avoir réalisé un examen physique en situation réelle avant d'avoir suivi le cours. Les facteurs les plus fréquents propres à dissuader le pharmacien de réaliser un examen physique étaient l'absence de formation officielle et le manque d'aisance. Tous les répondants ont indiqué que le cours avait accru leurs connaissances de l'examen physique, 96 % (76/79) ont affirmé qu'il avait amélioré leurs compétences et 90 % (71/79) ont déclaré qu'il avait amélioré leur capacité à soigner les patients. De plus, 61 % (48/79) et 67 % d'entre eux (53/79) ont indiqué respectivement qu'ils se sentaient à l'aise de réaliser des examens physiques et d'agir sur la pharmacothérapie du patient en fonction des résultats de l'examen. Trente-huit (17 %) participants ont répondu au sondage mené six mois après le cours. Ce sondage a révélé que le manque de temps était le facteur le plus souvent évoqué pour faire obstacle à la réalisation d'examens physiques. Des données appariées de 23 répondants ont montré une augmentation significative du recours à l'examen physique en situation réelle au fil du temps ($p = 0{,}013$ par test χ^2). Cependant, on n'a noté aucune amélioration significative de l'aisance à réaliser des examens physiques ou à agir sur la pharmacothérapie d'un patient en fonction des résultats d'un examen physique ($p > 0{,}05$ par un test t bilatéral). La principale limite de la présente étude était un biais potentiel dans les réponses.

Conclusions : Un cours sur l'examen physique conçu pour les pharmaciens a amélioré les connaissances et les compétences autodéclarées des participants ainsi que ce qu'ils croient être leurs capacités à soigner les patients. Six mois après le cours, deux tiers des répondants avaient réalisé un examen physique dans leur pratique. Cependant, on n'a noté aucune amélioration de l'aisance à réaliser de tels examens ou à en utiliser les résultats pour agir sur la pharmacothérapie du patient.

Mots clés : examen physique, pharmaciens, sondages et questionnaires

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INTRODUCTION

The role of the pharmacist has advanced over the past several decades, from a dispenser of medications to an integral member of the multidisciplinary health care team. Along with this expanded role, pharmacists are now seeking to broaden their expertise to include patient care activities that are relevant to assessing and monitoring drug therapy but that have traditionally been performed by other members of the health care team, such as physical assessment (PA).[1-5] This form of assessment involves systematically evaluating the body and its functions and consists of 4 specific skills: inspection, palpation, percussion, and auscultation.[6] Although most pharmacists routinely perform inspection, they often have little experience with other PA skills. The concept of pharmacists using PA in their practice is not novel. In 1999, the American Society of Health-System Pharmacists released a position statement recommending that pharmacists in primary care broaden their skills to include PA as part of their role in collaborative drug therapy management.[1] In 2007, the *Canadian Journal of Hospital Pharmacy* featured a Point Counterpoint debate as to whether pharmacists should perform PA.[2,3] This debate highlighted the usefulness of performing PA when assessing the efficacy and safety of drug therapy and emphasized that many pharmacists already perform aspects of PA (e.g., inspection) in their practice, but also noted that it may be more prudent to focus on existing skills rather than "venturing into a turf battle" with colleagues on the health care team.[2,3] Recently, Schindel and others[7] surveyed practising pharmacists to identify professional learning needs to facilitate an expanded scope of practice, and PA was identified as 1 of 3 key areas of training. Advancement of pharmacists' adeptness with PA may lead to increased efficiency in patient assessment and medication monitoring, which may in turn aid in affirming the pharmacist's role as an integral member of the health care team.

Historically, most entry-to-practice pharmacy programs (including that of the University of British Columbia) have not provided comprehensive PA training. As a result, there has been increased demand among practising pharmacists to receive this training as part of their continuing professional development. Recently, a PA course specifically designed for practising pharmacists was developed by the British Columbia Branch of the Canadian Society of Hospital Pharmacists (CSHP). The purpose of the study reported here was to evaluate pharmacists' perceptions and integration of PA into their practice after completing this course. The specific objectives of the study were to assess participants' knowledge, skills, and confidence in performing PA immediately and 6 months after completing the course; to examine participants' integration of PA into their practice; and to evaluate the content and format of the course.

METHODS

This prospective, cross-sectional study involved participants in a PA course.

Description of the PA Course

The course was developed specifically for practising pharmacists through a partnership between the CSHP British Columbia Branch and Langara College, Vancouver, and was sponsored by the College of Pharmacists of British Columbia. Eligible course participants were registered pharmacists (including pharmacy practice residents) in any practice setting; student pharmacists were not eligible to take the course. The course was offered 11 times (with up to 20 participants per course) between September 2015 and June 2017 in 3 different cities in British Columbia. It consisted of 30 hours of instructional contact time, which was facilitated by instructors (physicians and nurses) from Langara College and pharmacists with formal PA training from the CSHP British Columbia Branch. For the first year, the course was offered 3 times and included 24 h of required instructional time with 6 additional, optional hours of practical application of PA principles specific to drug therapy; the optional section of the course was taught by pharmacists with formal PA training from the CSHP British Columbia Branch. After the first year, the course was expanded to 30 h (with no optional component) to incorporate practical application sessions as part of the course.

Overall, the course consisted of five 6-h sessions delivered on the weekend over 5 or more weeks. The course material was delivered through a combination of lecture-based discussions and practice exercises. The course content included how to perform a general patient examination and measure vital signs, as well as how to perform PA techniques for various organ systems, including the nervous system, respiratory system, cardiovascular system, gastrointestinal system, and musculoskeletal system, as well as the head, eyes, ears, nose, and throat. Pharmacist instructors helped link these techniques back to the assessment and monitoring of drug therapy. Participants learned how to perform PA skills primarily on other participants, and used a simulator to learn how to identify abnormalities (e.g., adventitious lung and heart sounds, heart murmurs).

Development of the Survey Questionnaires

The study was based on 2 online voluntary, anonymous surveys. The questions were derivations of those used in a previous study by Barry and others,[5] evaluated for clarity and appropriateness by the research team. Because the questions were based on those in a previous study, they were not tested in a pilot survey. The survey administered immediately after the course (referred to hereafter as the postcourse survey) consisted of 25 questions (Appendix 1, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc), The survey administered 6 months after course completion (referred to as the 6-month follow-up survey) consisted of 7 questions (Appendix 2, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc).

Administration of the Survey Questionnaires

All pharmacists who completed the course were invited by e-mail to participate in the study. The e-mail addresses were obtained from course registration materials. There were no specific exclusion criteria; however, participants were required to have internet access and had to be proficient in English to complete the surveys. The first survey was distributed within a week after course completion and the second 6 months after course completion. The timing of the second survey was pragmatically selected for feasibility. Because of a lag between the start date of the course and approval of the study, the first and second cohorts (totalling 59 [27%] of the 218 participants overall) did not receive their first survey until 6 and 2 months, respectively, after completing the course. For both these cohorts, the 6-month follow-up survey was administered 6 months after course completion. The surveys were hosted by the University of British Columbia's survey tool (FluidSurveys) and distributed via e-mail by the CSHP British Columbia Branch, with one reminder e-mail 2 weeks after the initial invitation. Both surveys remained open from May 2016 to December 2017. Consent was implied for anyone who completed the survey. No incentives or remuneration were provided to course participants who responded to the surveys.

The study was approved by the Research Ethics Board at the University of British Columbia.

Analysis of Survey Responses

Descriptive statistics were used for analysis of survey responses. Identical questions regarding use of PA and confidence in performing PA were compared between the postcourse and 6-month follow-up surveys using a paired statistical comparison (paired 2-sided t test for Likert-scale questions and χ^2 test for dichotomous outcomes). For the Likert-scale questions, each response was assigned a numeric value (strongly agree = 5, agree = 4, neither agree or disagree = 3, disagree = 2, strongly disagree = 1), and a weighted mean value with standard deviation was calculated as the sum of the assigned numeric values of the responses divided by the total number of responses.

All statistical analyses were performed using IBM SPSS Statistics software (version 21, IBM Corporation, Armonk, New York). A p value of less than 0.05 was considered statistically significant.

RESULTS

A total of 218 pharmacists completed the PA course. Eighty-two pharmacists (38%) responded to the postcourse survey, and

Table 1. Characteristics of Survey Respondents

Characteristic	Survey Timing; No. (%) of Respondents			
	Immediately after Course (n = 77)*		6 Months after Course, Paired Sample (n = 23)†	
Age (years)				
20–29	14	(18)	2	(9)
30–39	37	(48)	12	(52)
40–49	15	(19)	5	(22)
50–59	11	(14)	4	(17)
Sex, female	60	(78)	18	(78)
Time working as a pharmacist (years)				
≤ 5	20	(26)	2	(9)
6–10	24	(31)	10	(43)
≥ 11	33	(43)	11	(48)
Highest level of pharmacy education				
Accredited residency	31	(40)	6	(26)
Entry-to-practice degree	27	(35)	8	(35)
Graduate Doctor of Pharmacy	16	(21)	8	(35)
Master of Pharmacy	3	(4)	1	(4)
Primary practice setting				
Hospital inpatient setting	44	(57)	13	(57)
Ambulatory clinic	13	(17)	2	(9)
Community pharmacy	12	(16)	2	(9)
Family medicine or primary care	3	(4)	3	(13)
Academia	2	(3)	2	(9)
Other	3	(4)	1	(4)

*Data are presented only for those who completed all questions in the survey administered immediately after course completion ("postcourse survey"). An additional 5 respondents answered some but not all of the questions.
†Data are presented only for the 23 respondents whose responses could be paired between the postcourse survey and the 6-month follow-up survey. An additional 15 respondents completed the 6-month follow-up survey, but the data could not be paired with their responses to the postcourse survey.

77 (35%) completed this survey in full. For reporting purposes, the number of participants who responded to each question is included as the denominator. Demographic characteristics of respondents to the postcourse survey are summarized in Table 1. Nearly half of respondents (39/79, 49%) stated that they had performed PA on a real patient before participating in the course, primarily fluid assessment, blood pressure measurement, and inspection of dermatological conditions. The 3 most frequently selected barriers to performing PA in practice before the course were lack of formal PA training or education (74/79, 94%), lack of comfort in performing PA (73/79, 92%), and lack of time to perform PA (66/79, 84%). The most frequently selected objective for taking the course was to improve skills and ability in performing PA (79/79, 100%). The postcourse survey results for the Likert-scale questions are summarized in Table 2. The most commonly stated strengths of the course were the mix of didactic and hands-on practice time (30/79, 38%), the expertise and quality of the instructors (22/79, 28%), and the small class size and instructor-to-participant ratio (5/79, 6%). The most common suggestions for course improvements were more hands-on practice time (31/79, 39%), more applicability to pharmacotherapy (18/79, 23%), and more instructional time (8/79, 10%).

Thirty-eight pharmacists (17%) responded to the 6-month follow-up survey, and all of these respondents completed the survey in full. Paired data were available for 23 (61%) of these 38 respondents. Demographic characteristics for the paired sample are summarized in Table 1. Six months after course completion, 66% of respondents (25/38) had performed PA on a real patient in practice. The 3 most frequently selected barriers to performing PA at the 6-month mark were lack of time to perform PA (31/38, 82%), lack of a need to perform PA because of access to information from other health care professionals (27/38, 71%), and lack of comfort with performing PA (26/38, 68%). When asked to identify the most beneficial aspect of using PA in practice, 55% of respondents (21/38) provided a response, which most frequently related to increased ability (6/21, 29%), confidence (5/21, 24%), and understanding (5/21, 24%). The 6-month follow-up survey results for the Likert-scale questions are also summarized in Table 2.

Table 2. Select Results of Follow-up Surveys

Statement	Response; % of Respondents				
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Immediately after course (*n* = 79)*					
The course improved my ability to care for my patients	30	60	9	1	0
The course improved my knowledge of PA	57	43	0	0	0
The course improved my skills and ability with performing PA	44	52	4	0	0
I feel confident with performing PA in my practice	15	46	32	8	0
I would intervene on a patient's drug therapy based on my PA findings	23	44	28	4	1
The course fulfilled my personal objective(s) for taking the course	28	58	9	5	0
The course provided a good connection between PA and pharmacotherapy	9	37	23	28	4
The length of the course was appropriate	18	51	16	15	0
The didactic content of the course was at an appropriate level	22	66	6	6	0
The amount of didactic instruction during the course was just right	19	56	10	14	1
The amount of hands-on practice time during the course was just right	14	39	11	30	5
6 months after course (*n* = 38)†					
I feel confident with performing PA in my practice	11	34	39	16	0
I would intervene on a patient's drug therapy based on my PA findings	21	61	18	0	0

PA = physical assessment.
*Data are presented for the 79 respondents who answered questions 6 to 16 of this survey (see Appendix 1, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc).
†Data are presented for the 38 respondents who answered questions 4 and 5 of the 6-month survey (see Appendix 2, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc).

According to the paired data, there was a significant increase in use of PA on a real patient in practice between the postcourse and 6-month follow-up surveys (48% [11/23] versus 65% [15/23], $p = 0.013$). However, there was no statistically significant difference in confidence in performing PA (weighted mean value 3.52 ± 0.79 in postcourse survey versus 3.39 ± 0.89 in 6-month follow-up survey, $p = 0.33$) or intervening on a patient's drug therapy based on PA findings (weighted mean value 3.70 ± 0.88 in postcourse survey versus 4.00 ± 0.67 in 6-month follow-up survey, $p = 0.11$).

DISCUSSION

This study has shown that a course specifically designed to teach practising pharmacists how to perform PA improved participants' self-reported knowledge, skills, and ability. Furthermore, 90% of respondents agreed that the course improved their ability to care for their patients. After the course, most respondents agreed they felt confident in performing PA and would intervene on a patient's drug therapy on the basis of their PA findings. However, there was no significant increase in agreement with these statements between the postcourse and 6-month follow-up surveys.

According to data from all respondents, the use of PA on real patients increased from 49% before the course to 66% by 6 months after the course. Interestingly, roughly one-third of respondents had not attempted to use their PA skills in practice by the time of the follow-up survey. A timeframe of 6 months should have been sufficient to allow pharmacists to incorporate PA into their practice, as the skills developed during the course could be applied immediately. At 6 months after the course, numerically fewer respondents felt confident in performing PA than was the case immediately after course completion, but more were willing to use their PA findings to intervene on a patient's drug therapy (though neither difference was statistically significant). This was an unexpected finding, as it is incongruent with respondents' self-reported improvement in skills and ability in performing PA, as reported immediately after the course. One possible explanation is that course participants found it challenging to apply their PA skills on real patients in practice, which thereby diminished their overall confidence. As such, despite having increased knowledge, participants may have felt less confident in performing the technical aspects of PA over time. This may have been due to a lack of time to practise their PA skills, or a lack of comfort in translating their skills from the classroom to the bedside, both of which were identified as barriers in the 6-month follow-up survey. Conversely, their increased intention to intervene on a patient's drug therapy on the basis of their PA findings may reflect an increased ability with specific PA skills relevant to their particular practice settings, but less confidence in performing PA overall. Still, despite having 6 months to practice, more than half of the respondents still did not agree they felt confident in performing PA.

A previous study by Barry and others[5] demonstrated that a 2-hour PA session for practising pharmacists ($n = 34$) improved participants' confidence in performing PA, answering a patient's concerns about PA findings, and discussing their findings with a physician, relative to perceptions reported before the session. However, as with the present study, the training session in that earlier study did not improve participants' confidence in intervening on a patient's drug therapy according to their PA findings. In the study by Barry and others,[5] there was no increase in the use of PA in practice among respondents after 4 weeks, which may have been due to the relatively short follow-up period. In another study, Breault and others[8] evaluated the impact of a 2-day, 16-h workshop intended to teach institution-based pharmacists ($n = 86$) how to perform PA, which was specifically designed to address the issues identified in the study by Barry and others.[5] The workshop significantly improved participants' overall confidence in PA, managing drug therapy based on PA findings, and discussing PA findings from before to 6 months after the workshop. At 6 months, about half of the participants continued to incorporate PA into their practices. Barriers to incorporating PA in practice at 6 months were similar to those reported in the current study, including lack of need (i.e., ability to access to this information from other health care professionals), lack of training, "treading on the turf" of other health care professionals, lack of comfort with performing PA, and lack of time.

In the current study, despite having 30 h of contact time, some respondents suggested that the course should have more instructional time and/or hands-on practice. However, more than two-thirds of respondents agreed that the length of the course was appropriate, and roughly three-quarters agreed that the amount of didactic instruction was just right. In contrast, only about half of respondents agreed that the amount of hands-on practice was just right. Therefore, if additional course time were to be added, it should focus solely on practical skill development. This study did not evaluate respondents' perception of the optimal amount of instructional time. As well, increasing the overall instructional time might deter some pharmacists from taking the course. One possible solution to improve participants' use of PA in practice without lengthening the course would be to hold informal in-person sessions where participants could share their successes and barriers with incorporating PA into their practice. This type of peer mentorship may promote engagement and motivation, and thus improve overall confidence in performing PA. One aspect not included in the course was the opportunity to perform PA on patients with pathologic findings, given that participants learned how to perform PA skills primarily on other participants or a simulator. Therefore, the opportunity to practise skills on actual patients in an instructional setting might further improve participants' skills and confidence. Finally, many respondents advocated for more applicability of course instruction to pharmacotherapy. As such, the course might have been improved through use of

additional pharmacist instructors with formal PA training who could provide more examples of how PA skills can be utilized to assess and monitor drug therapy.

For PA to become universally performed by pharmacists, one could hypothesize that it would need to be incorporated into entry-to-practice pharmacy programs, as well as postgraduate training programs such as residencies and fellowships. The *Accreditation Standards for the First Professional Degree in Pharmacy Programs*, developed by the Canadian Council for Accreditation of Pharmacy Programs, included PA as an example of a core clinical practice skill.[9] Although more than 200 pharmacists completed the PA course described in the current study, this sample represents a small percentage of the roughly 5800 pharmacists in British Columbia.[10] This number could be augmented by offering ongoing PA sessions for practising pharmacists as part of their continuing professional development. It might be surmised that most of the course participants were early adopters with a keen interest in incorporating PA into their practice, and thus not representative of most pharmacists practising in British Columbia. Further evidence for this supposition lies in the approximately 50% of respondents who had performed some type of PA on a real patient before the course. In the study by Barry and others,[5] only 38% of respondents had performed PA in their practice before taking the course. Thus, the results of the current study may overestimate the rate of utilization of PA in practice. However, demand for PA sessions for existing practitioners may escalate with a higher number of newly graduated pharmacists having these skills.

This study had limitations that warrant discussion. The primary limitation was the low response rate, particularly for the 6-month follow-up survey. However, baseline characteristics for those completing the 6-month follow-up survey (based on the paired data) were consistent with and representative of the overall postcourse survey respondents, although the paired sample may have been too small to detect any statistically significant differences between the 2 surveys. Both surveys had a risk of responder bias, as participants who are eager to utilize PA in practice may have been more likely to complete the surveys. Furthermore, the delay in inviting the first 2 cohorts to participate in the study may have introduced recall bias, whereby respondents may have incorrectly estimated their confidence in performing PA immediately after the course. Additionally, this study relied on respondents' self-reported understanding and behaviour, and did not objectively assess their PA knowledge or their ability to perform PA. As well, the study did not assess PA knowledge and skills before the course. Respondents were asked to create their own unique identifier (based on their licence number and year of graduation), yet only 61% (23/38) of respondents to the 6-month follow-up survey could be paired with their first survey. Finally, the results are primarily representative of pharmacists who have postgraduate training (given that only 35% of respondents had an entry-to-practice degree as their highest level of pharmacy education) and practice in a health authority setting, such as an inpatient hospital or ambulatory clinic (given that this category encompassed about 75% of respondents). Data on location of practice setting (e.g., urban versus rural) were not collected.

Future research should focus on ways to increase pharmacists' utilization of PA in practice, as only about two-thirds of respondents had used their PA skills in practice by 6 months after the course. A similar result was evident in the study by Breault and others,[8] in which only about half of respondents were using PA in practice by 6 months after a workshop. Future training programs should maximize opportunities for pharmacists to develop their practical PA skills through hands-on activities and should ensure that the material is relevant to pharmacotherapy. The optimal length of a PA course is debatable: the current study showed that despite 30 h of contact time, many pharmacists lacked confidence in performing PA in practice, yet longer courses may discourage participation.

CONCLUSION

As the scope of pharmacy practice continues to expand, there will likely be increased demand for professional development training programs aimed at developing clinical skills, such as performing PA. A course specifically designed to teach pharmacists how to perform PA improved participants' self-reported knowledge and skills in performing PA, and improved their self-perceived ability to provide care to their patients. Six months after the course, most respondents had used their PA skills on a real patient in their practice. Compared with immediately after the course, fewer respondents felt confident in performing PA, but their willingness to intervene on a patient's drug therapy on the basis of their PA findings increased, although neither comparison was statistically significant. Future PA training programs should optimize hands-on practice time and relevance to pharmacotherapy, and should focus on methods to increase pharmacists' utilization of and confidence in performing PA in practice.

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Hospital Pharmacy Practice and the Way Forward for Pharmacy Education in Thailand

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COUNTRY BACKGROUND AND IMPORTANT HEALTH STATISTICS

Thailand is located in the centre of the Indo-Chinese peninsula; its land area of about 514 000 km^2 makes it the third largest country in Southeast Asia, after Indonesia and Myanmar.[1] The country is geographically and administratively separated into 5 regions and 77 provinces. In 2017, the population was estimated at about 66.23 million.[1] The age structure has undergone dramatic changes within the past 50 years. In particular, it has been estimated that the proportion of the population 60 years or older will increase substantially, from 11.9% in mid-2017 to 15.9% in 2020.[1]

According to the World Health Organization,[2] ischemic heart disease was the leading cause of death in Thailand in 2010, followed by stroke, lower respiratory infection, and road injury. Cardiovascular diseases, diabetes, and cancer were major causes of premature mortality, reducing healthy life years through increased likelihood of disability.[2]

Total health expenditure has been increasing over time. In 2010, it was estimated at about US$13 000 million (at the exchange rate of 32 Thai baht per US$1), and in 2012, it accounted for about US$15 639 million (at the exchange rate of 30.47 Thai baht per US$1).[3] These figures represented about 4% of the gross domestic product in their respective years.[3] Hospitals are the most important group of service providers of Thailand, consuming 68.3% of total health expenditure in 2012.[3] The overall value of domestic drug consumption was US$4518 million, of which anti-infective agents made up the largest share.[3]

OVERVIEW OF THE HEALTH CARE SYSTEM

The Ministry of Public Health (MoPH) plays an important role in the management of the Thai health care system. Under the central government, the MoPH provides policies and services that are grounded in medical ethics, with a view to promoting greater equality of access to health services across population subgroups in Thailand. Services provided by the MoPH include health promotion, disease prevention, medical care, and rehabilitation at all levels (primary, secondary, and tertiary).

Thailand has 3 main public health insurance schemes: the Civil Servant Medical Benefit Scheme, the Social Security Scheme, and the Universal Coverage Scheme. The last of these, initiated in 2001, was originally known as the "30 baht for all diseases" scheme, where the term "30 baht" referred to the amount of copayment that beneficiaries were required to contribute upon visiting a health facility.

The 3 schemes differ in terms of their management, sources of financing, and beneficiaries. The Civil Servant Medical Benefit Scheme covers government officers and their families, which make up about 8% of the population.[4] The scheme is operated and monitored by the Comptroller General under the Ministry of Finance. The financing source is general taxes, with an annual budget of about US$400 per person.[4] The Social Security Scheme covers employees in the private sector, which represent 16% of the population.[4] Managed by the Social Security Office (which is affiliated with the Ministry of Labor), the scheme is financed through contributions from employers, employees, and the government. The annual budget under the Social Security Scheme is about US$106 per person.[4] Finally, the Universal Coverage Scheme covers individuals who are not covered by either of the other 2 schemes. The number of Universal Coverage Scheme beneficiaries today stands at about 48 million (75% of the population). The National Health Security Office administers the scheme, which is financed through general tax revenue, with an annual budget of about US$84 per person.[4] Additionally, Thailand has private health insurance.

Implementation of the Universal Coverage Scheme has increased access to health care, particularly among people living

in poverty, promoting health security and health equity, as well as decreasing the financial burden for patients.[5] Since its inception, efforts and investments in health information systems at the national and institutional levels have increased. The Health Information System Development Office and the Health System Research Institute have been established to produce a standard set of health data and to develop health information system indicators. Also, the National Health Security Office (which manages the Universal Coverage Scheme) has invested in an extensive information system at the national level; its purposes are to better orchestrate the delivery of integrated health care activities and to make efficient use of health and drug information, which would subsequently lead to improvements in the claims and reimbursement processes, the central procurement system, delivery of integrated primary care, and provincial administrative health budgeting.[6,7]

PHARMACY PRACTICE IN THAILAND

All pharmacists in Thailand undertake the same basic undergraduate training before selecting the sector in which they will work after graduation. According to a study by the Pharmacy Education Consortium of Thailand,[8] more than half of the pharmacy workforce (68%) is employed in pharmacy service settings, including public hospitals (33%), private hospitals (7%), and drugstores (28%). An additional 22% work in manufacturing and marketing (16%), consumer protection (4%), and education (2%). The remaining 10% of pharmacy graduates work in careers outside pharmacy. This article focuses primarily on hospital pharmacy practice.

Hospital Pharmacy Practice

The practice of hospital pharmacy in Thailand has evolved over time. Before 1990, hospital pharmacy practice mainly involved drug procurement, distribution, and dispensing of pharmaceutical products to hospital inpatients and outpatients. In the early 1990s, the concepts of clinical pharmacy and pharmaceutical care were introduced to Thai hospital pharmacists. Consistent with the vision of the Pharmacy Council of Thailand, which states that "The philosophy of pharmaceutical care is the ultimate goal of professional achievement", the MoPH and schools of pharmacy from 4 regional universities established a collaborative project, with the goals of engaging hospital pharmacists with pharmaceutical care concepts and stimulating the expansion of their practice to involve more patient care.[4] The project provided extensive retraining, and hospital pharmacists who chose to participate were required to attend a 5-day workshop to gain pharmacotherapy knowledge and pharmaceutical care skills. The workshop content included pharmacokinetics, therapeutic drug monitoring, adverse drug reactions, medication-use evaluation, and research methodology. Pharmacy continuing education credits approved by the Pharmacy Council of Thailand could also be earned by attending the workshop. The focus of hospital pharmacy practice in the country has since shifted from pharmaceutical products to patient care.[7]

The quality of pharmaceutical care in Thailand has been further strengthened through health service development plans and implementation of a rational drug-use system by public hospitals under the supervision of the MoPH. In addition, the Healthcare Accreditation Institute was set up in 1999.[9] It serves as the main organization to promote quality assurance of hospitals in the country, thereby improving the quality of health services. All operations within a given hospital, including the medication system and management, must comply with the standards set out by the Healthcare Accreditation Institute, and all hospitals are required to undergo assessment and accreditation.[9] The accreditation requirement applies also to secondary and tertiary public hospitals. Given that these hospitals typically have a large catchment area to serve and a wide range of services to provide, their pharmacy management systems are likely to be detailed and complicated, requiring knowledgeable human resources and an efficient operation system.[9]

Pharmacy departments constitute an integral component of hospitals. In public hospitals in particular, pharmacy departments are responsible for pharmaceutical services and are partially responsible for the outcome of health services and the overall treatment of patients.[10] They are also required to maintain hospital standards.[10] The functions of pharmacy departments in Thailand include pharmaceutical management (drug procurement and inventory), drug dispensing, drug preparation (such as extemporaneous preparations and IV admixture), consumer protection (concerning safe use of all health-related products), drug information services and pharmaceutical care. Thai public hospitals have the autonomy to modify the structure of their pharmacy departments in accordance with the context in which they operate. However, the MoPH requires that the drug management system within each hospital be subject to supervision by a cross-functional, multidisciplinary team known as the Pharmacy and Therapeutics Committee, comprising doctors, pharmacists, nurses, and hospital administrators.[10]

The drug distribution system[10] within a public hospital comprises various activities. First, the system involves drug procurement, whereby the procurement unit purchases drugs from pharmaceutical companies. Because all public hospitals provide services to beneficiaries of public health insurance schemes (as explained above), drug procurement is accomplished through an e-claim system set up by public health insurance agencies for the purpose of compensation disbursement. Only drugs specified in the National List of Essential Medicines can be procured through the system; this list contains a broad range of drugs. Protected under the doctrines of national health security and social security,[10] patients have the right to access all drugs on the list,

which allows them to obtain expensive medicines that would be otherwise unaffordable.

As a second stage in the drug distribution system, purchased drugs are stored in the main stockroom and sub-stockrooms and subsequently distributed to the dispensing unit. Some hospitals set up control systems for drugs for which access needs to be limited and closely monitored, including narcotics and psychoactive substances.[10] The control system involves documenting disbursement of these drugs on a monthly basis and filing the reports with the Thai Food and Drug Administration.

Finally, the drug distribution system includes drug dispensing. In the outpatient drug distribution system,[9,10] hospital pharmacists perform a general check for the availability of drugs and identify drug-related problems during the dispensing process. In cases where drug-related problems exist for a given patient, pharmacists work with a multiprofessional health care team (consisting of pharmacists themselves, along with doctors and nurses within the hospital) to come up with potential solutions before giving drugs and advice to the patient. Monitoring and surveillance systems are put in place for the use of high-risk drugs. In the inpatient drug distribution system,[10] the principle whereby each hospital ward maintains sufficient stock for 1 day of operation is applied. The Pharmacy and Therapeutics Committee determines the types of drugs and the quantity of each drug to be kept in stock, enforcing a drug monitoring system as well as a risk identification and management system. The goals are to ensure maximum efficiency and safety of drug usage and to reduce drug and health expenses for patients.

FACTORS AFFECTING HOSPITAL PHARMACY PRACTICE AND ROLES OF HOSPITAL PHARMACISTS

Changes in hospital pharmacy practice and roles of hospital pharmacists in Thailand can be attributed to many factors. First, the establishment of the Healthcare Accreditation Institute in 1999 has played a crucial role in upgrading the quality of health care in Thailand, leading to the institutionalization and implementation of standards for hospital pharmacy. More specifically, since 2002, the Healthcare Accreditation Institute has promoted and supported the standardization of pharmacy services, such as extemporaneous preparations (e.g., parenteral nutrition and cytotoxic IV admixtures) and the improvement of pharmaceutical care services for both outpatients and inpatients.[9] The Institute has also encouraged formal collaboration between pharmacists and other health care professionals in hospital settings, which has resulted in a substantial decrease in adverse events related to medications.[10]

Second, the MoPH has annual health service plans,[11] which currently focus on the improvement of efficiency of overall hospital management and the disease management system, to decrease health-related mortality and morbidity. The plans are categorized into 19 groups, in accordance with major health problems within the Thai population, namely heart diseases, cancer, accidents, newborn health, mental health and psychiatry, primary care and district health services, oral and dental care, kidney diseases, eye diseases, non-communicable disease, Thai traditional and alternative medicines, organ donation and transplantation, intermediate and palliative care, development of rational drug use system, surgery drug misuse and addiction, internal medicines, maternity and child care, and orthopedics. The plans have most recently been expanded, and they now include the principle of rational drug use with a view to improving the drug system and its management such that it is compliant with the management of health service plans by the MoPH.[11]

Third, under the provisions of the Universal Coverage Scheme, a public health insurance scheme that covers the majority of the population, each public hospital is linked with primary care units and is responsible for setting up family medicine teams to provide home health care; these teams often include hospital pharmacists. On a related note, hospital pharmacists are tasked with the promotion of patient self-care. These new roles related to primary care by hospital pharmacists are institutionalized through by a number of government policies such as the 2017 Constitutional Law, the National Health Assembly's Strategic Plan (2007–2016), the Strategic Plan for Health Education for the 21st Century (2014–2018), the Strategic Plan for the Decade of Primary Care Systems (2016–2026), and the 20-year National Strategy on Public Health.[10,11]

Finally, in addition to shifts in health policies and the institutionalization of quality assurance among hospitals, a variety of socioeconomic factors influence hospital pharmacy practice. These factors include increasing morbidity and mortality associated with noncommunicable diseases, public expectations of hospital services, aging of the population, and the emergence of a digital society, all of which have produced a constantly changing environment in which hospital pharmacy is practised and have led to changes in hospital pharmacy practice itself.[12] In particular, it has been observed that, since 2010, hospital pharmacists have become more specialized. As patients are increasingly more diverse and management of the medication system has consequently become more complex, there is a greater need for increased knowledge and skills in pharmaceutical care among pharmacists.[12] As a result, several associations of hospital pharmacists have been formed to update academic knowledge and clinical skills for their members. Currently, Thailand has 8 hospital pharmacy groups, called "communities of practice": the Adverse Drug Reactions Community of Pharmacy Practice Thailand, the Pharmacist Initiative for Patients Living with HIV/AIDS Thailand, the Group of Thai Aseptic Dispensary Pharmacy Practitioners, the Thai Pharmacist Practitioner Group in Asthma and COPD [chronic obstructive pulmonary disease], the Thai Pharmacy Community of Practice for Diabetes Care, the Society of Family Pharmacists Thailand, the Community of Pharmacists for Heart

and Vascular Diseases of Thailand, and the Thai Renal Pharmacist Group.[12]

PHARMACY EDUCATION FOR HOSPITAL PHARMACY PRACTICE

Pharmacy Education

As approved by the Pharmacy Council of Thailand, there are 19 pharmacy faculties in 14 public and 5 private universities throughout the country. They offer professional pharmacy degrees that are accredited by the Thai Qualifications Framework for Higher Education. All practising pharmacists must obtain a degree known in Thailand as "Doctor of Pharmacy (PharmD)". The degree takes 6 years to complete, is equivalent to a combined bachelor's and master's degree, and should be distinguished from the Doctor of Philosophy in Pharmacy (PhD in Pharmacy). The PharmD program encompasses 3 possible tracks: pharmaceutical care,[13] industrial pharmacy,[14] and consumer protection in drugs and health.[15] Most universities provide both the pharmaceutical care and the industrial pharmacy tracks. Five universities provide only the pharmaceutical care track, and 2 universities have recently introduced the track for consumer protection in drugs and health.[16]

The pharmaceutical care track is tailored for practice in hospital settings. All students study preclinical courses in their first 3 years and then select from a range of elective pharmacy courses during their final 3 years. Under the minimum requirement of 220 credits and certain minimum credits for each subject domain (e.g., 30 credits for general education, 114 credits for the pharmacy profession, 6 credits for electives, and 30 credits for basic sciences), universities are able to shape their graduates by designing curricula that meet specific needs of the health system.[16]

Regardless of their specialty (track), all graduates must meet core professional competency standards set by Pharmacy Council of Thailand.[17] They are required to take and pass a national licensure examination after completion of their sixth-year clerkship. Also, PharmD students enrolled from 2014 onward must pass 2 examinations: the Pharmacy Licensure Examination Core Competency, which is compulsory for all students and is to be taken after completion of the fourth year and a clerkship,[18] and an additional examination to specifically evaluate their competency regarding the specialty track (either industrial pharmacy or pharmaceutical care).[18] However, regardless of their specialty track, all graduates receive the same professional license from the Pharmacy Council of Thailand.

For Thai pharmacists, education continues after graduation. The Pharmacy Council of Thailand has, since 2016, required that all pharmacists participate in continuing pharmaceutical education. The purpose is to ensure that the knowledge and competency of practising pharmacists are standardized and continually updated in the dynamic context of the health system in which they work. Pharmacists are expected to acquire at least 100 credits within 5 years and not less than 10 credits in any given year.[19] Continuing pharmaceutical education credits can be earned through several activities, such as attending an academic conference and e-learning. Pharmacists who graduated after 2015 need these credits to renew their licence every 5 years.

In total, the pharmacy faculties throughout the country recruit about 2000 students annually. The average number of newly licensed pharmacists is 1700 per year, with a 2% loss rate per year. In 2016, there were 28 896 pharmacists, about 40% of whom worked in a hospital.[20]

Pharmacy Education in Response to Shifts in Hospital Pharmacy Practice

Pharmacy education in Thailand has evolved since its inception in 1914, both in terms of study years and content. These changes are attributable to many factors, such as changing health needs of the population, international and national policies regarding health care, health care system reforms, and advancement in knowledge and technologies.[21] The development of pharmacy education to serve the changing needs of the health care system and the changing practices of hospital pharmacy are summarized in Box 1.[16,20,22-25]

Similar to the PharmD program in the United States, the original intent of expanding the pharmacy curriculum to a 6-year PharmD program was to develop expertise in pharmaceutical care.[26] This change took place in spite of initial concerns from the wider profession,[27,28] and graduates themselves now see the advantages to be gained from specialization in the additional year.[29]

With regard to the number of pharmacy graduates to meet the needs of the society, the Pharmacy Education Consortium of Thailand, an independent agency consisting of deans of pharmacy faculties nationwide, has agreed to encourage at least 200 pharmacists per year to continue their education (in the form of a diploma or a certificate) and, focusing on primary care and herbs, to produce at least 100 herbal pharmacists per year.[8] The Consortium is currently planning to organize a public hearing on the final draft of the competency framework for future pharmacists (2016–2026), which has been developed on a needs-based approach.[29,30]

Challenges Ahead for Pharmacy Education under the Needs-Based Approach

To design pharmacy education for future hospital pharmacists, further reform is needed. Without workforce planning that takes into account future pharmacy roles, the pharmacy workforce will not have the capacity to meet the needs and expectations of the health care system. In light of the increasing complexity of drug and health care systems in Thailand, the challenges for future

Box 1. Pharmacy Education in Response to Changes in Pharmacy Practice[16,20,22-25]

Doctor of Pharmacy (PharmD) Training

Duration of Basic Pharmacy Education

The pharmacy curriculum has been extended from a 5-year bachelor degree program to a 6-year Doctor of Pharmacy (PharmD) program. The change began in 1999 in a single public university and was finally rolled out to all universities in 2008. The PharmD curriculum requires a high proportion of practice hours, with the ratio of study periods for the theory component of the curriculum, the practice component, and the research component being 51:47:2.[20] Specifically, the following requirements must be fulfilled: 200 training hours in a community pharmacy and 200 training hours in a district hospital (providing secondary care) after the fourth year of course work; 1600 training hours through 6 or 7 clinical rotations in the sixth year, with a 6-week period for each rotation, with at least 4 rotations selected from community pharmacy, primary care, ambulatory care, acute care, medication management, or consumer protection, and 2 or 3 elective clerkships relevant to the trainee's sub-track. The increasing number and competency of PharmD preceptors supports the extension of these clerkships.

Separation of Specialty Tracks

The depth of pharmacotherapy training in the pharmaceutical care track (which trains graduates to work in tertiary care hospitals) is different from the other tracks.

Transition of Teaching Model

The teaching model has shifted from lecture-based teaching to transformative learning, with an emphasis on outcome-based education and experiential learning at all levels of the hospital and the community settings, with interprofessional education. Teaching materials and tools have been developed in response to national policy movements; for example, a teacher's guide (manual) on rational drug use[22] and a curriculum guide on patient safety[23] have been developed at the national level.

Postgraduate Training

Hospital pharmacists can advance their careers through postgraduate training.

Master's Degree in Clinical Pharmacy (2-year program) and PhD (4-year program)

Apart from a full-time master's degree program in clinical pharmacy, credits can also be earned in a module system, in collaboration with the Health Administration Division, Office of the Permanent Secretary of the Ministry of Public Health, and 4 regional pharmacy faculties in the country, namely Chiang Mai University, Khon Kaen University, Prince of Songkla University, and Silpakorn University.[24]

Residency Program and Short-Term Training Courses[25]

The College of Pharmacotherapy of Thailand provides a residency program in pharmacotherapy; a 4-year program for a specialized fellowship; and 1-year or 3-year program for a certificate of general residency in pharmacotherapy and a certificate of specialized residency, respectively. A residency program in health consumer protection is also available from the College of Pharmaceutical and Health Consumer Protection of Thailand. In addition, hospital pharmacists can take short-term (3-month) training courses in specific areas, such as pharmaceutical care in cancer, outpatient care, therapeutic drug monitoring, palliative care, asthma, and chronic obstructive pulmonary disease.

pharmacy education are outlined in Box 2,[16,28-30] separated into supply-side and demand-side issues.

Thai hospital pharmacists have a broad range of responsibilities from drug system management to patient care services, and from tertiary care to primary care services. Under the government's universal health coverage initiative (whereby the entire population is covered under a public health insurance scheme), primary care responsibilities have been increasing for hospital pharmacists. These responsibilities require a holistic mindset and a systems approach, marking a significant departure from how hospital pharmacists have been trained in the formal education system.

To prepare the pharmacy labour force for these changing needs, every party in the pharmacy profession has an important role to play. Pharmacy educators should redesign their curricula further such that graduates will be well equipped with both technical specialty skills and "soft skills". Pharmacy workforce leaders should encourage members of the profession to collect evidence to strengthen the demand for pharmacy human resources.[30]

The Pharmacy Council of Thailand and other professional organizations will also need to work together in redefining the profession to highlight the contribution of pharmacy services to society, and to readjust the pharmacy competency framework to reflect new emerging roles of pharmacists. They should also refine evaluation methods used to determine competency of graduates and establish a feedback mechanism that would serve as a platform for better workforce development. An example of a change in this direction involves distinguishing different pharmacy licences for each specialty track, such that the competency development for different types of pharmacists in the workforce can be better focused.[16]

Workforce Planning

For many years, there have been insufficient pharmacists to meet the needs of the population. In 1984, to address this shortage, the Thai government mandated that all graduating pharmacy students work in a public hospital for 2 years. This resulted in higher recruitment of pharmacists, particularly to rural community hospitals, and enhanced drug-related patient safety; however, because of financial constraints, the number of government-funded pharmacists was capped in the year 2000. However, universal health care coverage and improved pharmacy performance standards have resulted in an increased demand for pharmacists and so, in 2006, an alternative scheme was introduced whereby pharmacy students were required to sign a

Box 2. Supply-Side and Demand-Side Challenges for Future Hospital Pharmacists[16,28-30]

Supply Side

How can pharmacy education improve learners' competencies to serve the demands of hospital pharmacy practice in Thailand?

- Roles of hospital pharmacists in Thailand include not only drug dispensing, but also drug-system management, consumer protection, and a variety of primary care services.[28]
- Pharmacy curricula are designed primarily to develop clinical pharmacy skills appropriate for tertiary care hospital services.[28]
- Greater needs for primary care services are emerging, and they require a holistic mindset and systems approach. The skills needed here differ from those required in tertiary care services.[16,30]
- Soft skills (e.g., systematic thinking, critical thinking, leadership, lifelong learning) are essential for the 21st century. They need to be integrated more formally into pharmacy curricula.[29]
- The varying degrees of depth and breadth of knowledge and skills required for entry-level and advanced pharmacy practices need to be more carefully aligned, which will require wider discussion within the profession.[16]
- Postgraduate training programs designed for advanced professional development(.e.g., short courses and e-learning/ massive open online courses, also known as MOOCs), are in demand, yet the supply of such courses seems to be limited.

Demand Side

How can the high demand for pharmacists be sustained, both qualitatively and quantitatively? The following steps should be taken:

- Redefining the roles of the pharmacist so as to gain trust and acceptance from society.
- Finding evidence to highlight the significance of pharmacy services.
- Putting in place recruitment procedures to ensure a good workforce–workplace match.
- Providing continuing professional development that is designed specifically to enhance the career path of hospital pharmacists.

one-sided contract in which they agreed to work for at least 2 years under the auspices of the MoPH if required.

Despite these measures, demographic changes such as the aging population, globalization, and digital health have all resulted in further demands on the pharmacy workforce and ongoing workforce shortages. This is best illustrated quantitatively. A dynamic modelling study[8] estimated that by 2026 the number of pharmacists working under the auspices of the MoPH would be insufficient based on the projected needs of the aging Thai population. Specifically a further 24 774 pharmacists would be required to deliver the health service plans as envisaged in the 20-year National Strategic Plan. Put another way, 3.73 pharmacists would be needed for every 10 000 people.

The implication is that the MoPH will need to recruit 1602 more pharmacists per year for 10 consecutive years, to solve the supply shortage within the ministry alone. The Pharmacy Education Consortium of Thailand has suggested that the government reconsider the government–pharmacy student agreement, and more formally include pharmacist positions in the ministry, increasing the number of spots from 350 to 1600 per year.[8]

CONCLUSION

Increasing demands and costs of delivering health care pose major challenges for health services in Thailand. The cooperation of health-related stakeholders, including patients, policy-makers, and health care professionals, is core to identifying a sustainable solution. Hospital pharmacists represent a key group of stakeholders who can play an important role by working collaboratively with other health care professionals to provide efficient health care services and drug system management, leading to a reduction in unnecessary and preventable health care costs. However, there are challenges for Thai hospital pharmacists who take on extended roles. These include a requirement for in-depth clinical knowledge and skills and more specialized understanding of the pharmacotherapy of diseases, as well as improved medication management skills, and systematic and critical thinking. There are also new opportunities for extended roles for pharmacists to provide holistic care at the primary care level, including home health care and community-based care.

To date, educational establishments have responded to these challenges by providing appropriate undergraduate and postgraduate training, residency programs, and continuing education curricula. The 6-year PharmD curriculum should now be revised to be more outcome-based, developing competences and increasing interprofessional learning. In the future, Thai pharmacists working in hospitals, the community, or academia will all have a core set of advanced competencies to serve the needs of society.

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INTERNATIONAL PERSPECTIVES ON PHARMACY PRACTICE / PERSPECTIVES INTERNATIONALES SUR LA PRATIQUE PHARMACEUTIQUE

The article about pharmacy practice in Thailand appearing in this issue of the *Canadian Journal of Hospital Pharmacy* (*CJHP*) brings to a close the series International Perspectives on Pharmacy Practice. The *CJHP* Editorial Board initiated the series in late 2015, with the goal of "describing health care systems around the globe and the role that pharmacists play within these systems."[1] International authors were invited to share their respective countries' "approaches to providing pharmaceutical care and information about services offered in hospital, community, and other related health care settings." The Editorial Board hopes that through this series, readers have come to "better understand and learn about other practice innovations and systems and … gain an appreciation for pharmacy practices globally."

The series comprised articles on 13 countries[2-14] representing the 6 regions defined by the World Health Organization: Africa, the Americas, South-East Asia, Europe, the Eastern Mediterranean, and the Western Pacific. The following is a complete list of the articles in this series:

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The Advanced Pharmacist Practitioner: A New Series in the *Canadian Journal of Hospital Pharmacy*

Stephen Shalansky

INTRODUCTION

Given the success of 2 previously published series in the *Canadian Journal of Hospital Pharmacy* (*CJHP*)—on research methodology and international pharmacy practice—the Journal's Editorial Board began collecting ideas for a new series of articles based on a common theme thought to be of particular interest to hospital pharmacists. An online survey of *CJHP* readers, carried out in 2017, revealed a strong interest in the concept of the "advanced pharmacist practitioner". The Editorial Board therefore selected this broad topic as the theme for the new series. Those responding to the survey suggested that there are many examples of established advanced pharmacist practices, as well as emerging roles with progressive approaches that are moving the profession forward in innovative and exciting ways. The new series will feature examples of cutting-edge pharmacy practice in various settings, teaching models, research, initiatives undertaken by pharmacy professional societies, and other concepts highlighting new directions in hospital pharmacist practice. We, the members of *CJHP*'s Editorial Board, hope that these articles will stimulate ideas for hospital pharmacists across Canada and beyond, to advance the profession and improve patient care.

BACKGROUND TO THE SERIES

Several pharmacy professional societies have published descriptions of advanced practice roles and future directions for advancing the profession. These descriptions have commonly referred to clinical pharmacists' involvement in complex clinical cases, whereby they are moving their practice into new roles and taking increased responsibility for patient care outcomes. These advanced practice pharmacists take leadership roles and are often involved in clinical or practice-based research that provides evidence for new ways that pharmacists can contribute to patient care. Many advanced practice pharmacists also take on innovative roles in teaching and preceptorship. As described below, specific responsibilities within advanced practices are also the focus of some pharmacy professional society initiatives, including pharmacist prescribing, physical examinations, research skills, and pharmacogenomics.

Pharmacist Prescribing

Perhaps no topic is more commonly associated with the concept of advanced practice than pharmacist prescribing, and there is considerable debate even within our own profession about how prescribing models should be implemented.[1] Regulations and practices differ considerably across Canada, and a recent comparison of prescribing practices highlighted these differences.[2] Alberta is generally considered to have the most comprehensive prescribing authorities, and has had in place specific requirements for full prescribing longer than any other province. However, other provinces have made considerable progress in recent years. Pharmacists are often considered to be underutilized in the health care system, so there is ample opportunity to expand pharmacists' roles. Obtaining the authority to prescribe can be the "tipping point" for taking on broader roles and responsibilities in various hospital settings. Although clinical pharmacists working in inpatient settings have gradually taken on many aspects of prescribing (e.g., altering doses and continuing medications that were taken before admission), hospital pharmacists working in ambulatory settings often have more limited roles, particularly in situations where provincial regulations prevent community pharmacists from filling prescriptions written by hospital pharmacists. However, the granting of full prescribing privileges can allow clinical pharmacists to take on broader responsibilities and provide comprehensive care to ambulatory patients in a more cost-effective manner than physician-based models.[3] Other key considerations for pharmacist prescribing include acquiring the ability to

independently order laboratory tests, scheduling coverage when the original pharmacist prescriber is away, obtaining remuneration where applicable, and teaching prescribing skills in Canadian pharmacy curriculums.[2]

Physical Examination by Pharmacists

Along with prescribing, physical examination is another key component of many existing and proposed advanced practice roles for pharmacists. By becoming proficient in physical examination, clinical pharmacists can become more independent practitioners, directly applying the findings of their physical assessments when they are selecting effective drug regimens. This topic was debated in recent correspondence published in *CJHP*,[4-6] where Mohammed and Yeung[5] described some skepticism on the part of nurses and physicians about pharmacists' physical examination skills. Although Mohammed and Yeung[5] provided suggestions regarding how pharmacists could more effectively implement physical examination into their front-line practice, Turgeon[6] also pointed out that thorough physical assessment training programs currently exist in which pharmacists are taught hands-on skills by qualified physicians and pharmacists. In preparation for new graduates taking on more advanced direct patient care roles, many faculties of pharmacy now include physical examination skills in their curriculums.

Research Skills

Research skills are also a key component of many pharmacists' advanced practice roles. Several pharmacy professional societies promote research training and grant opportunities through their research arms, including the Canadian Society of Hospital Pharmacists (CSHP) Foundation,[7] the American Society of Health-System Pharmacists (ASHP) Foundation,[8] and the American College of Clinical Pharmacy (ACCP) Research Foundation.[9] A survey of Canadian critical care pharmacists illustrated various degrees of clinical research participation, but the majority of respondents had taken research methodology courses and had a strong interest in pursuing research activities.[10] Although many professional societies, including those mentioned above, include participation in research as a desirable activity, the results of this survey suggest that further support and recognition by hospital pharmacy administration is required.

Pharmacogenomics

As another example of the expanding skill set of advanced pharmacist practitioners, many pharmacists are working toward integrating pharmacogenomics into their patient care roles, and pharmacy faculties have begun to include pharmacogenomics courses in their curriculums.[11-13] There are undoubtedly many other specific activities that could be added to pharmacists' roles and responsibilities to increase their direct impact on patient care outcomes.

CURRENT STATE OF ADVANCED PHARMACIST PRACTICE

Specific Settings

Advanced pharmacist practice can be defined in many ways, so it is helpful to look at specific examples where pharmacists have taken on unique duties and responsibilities to push the boundaries of their traditional roles.

One of the earliest and most common examples of advanced practice pharmacists can be found in many intensive care units across North America, the United Kingdom, and Europe. Critical care pharmacists have taken on diverse roles and are considered by the Society of Critical Care Medicine as essential members of the multidisciplinary team.[14] Their activities have been demonstrated to improve quality indicators, reduce errors, shorten the length of hospital stay, and decrease health care expenditures.[14,15] Rather than focusing on specific target interventions, critical care pharmacists have taken on new and cutting-edge roles, including intervening with respect to a wide variety of medication classes and taking responsibility for non-medication interventions involving target end points for mechanical ventilation and prevention of ventilator-acquired pneumonia.[15] Borthwick[16] has described the role of the pharmacist in UK intensive care units, pointing out that a high proportion of critical care pharmacists are also prescribers. Advanced practice pharmacists have also taken on integral roles as members of cardiovascular teams, and cardiology was recently added as a new certification discipline by the Board of Pharmacy Specialties.[17] Pharmacists have taken on expanded roles in other complex critical care settings, including emergency departments, where they participate in trauma rounds, procedural sedation, resuscitation, and intubation.[18] Surgical wards also represent a practice setting well suited for independent pharmacist roles, given that surgeons are often not directly available for immediate patient care decisions.

There are numerous models of advanced pharmacist roles in settings other than specialized acute care wards. For example, antimicrobial stewardship roles, which are increasingly common, require a combination of advanced knowledge applied to the treatment of infectious disease and expertise in influencing prescribing behaviours. These roles are often multidisciplinary and have been officially supported by a range of pharmacy and infectious disease professional societies.[19] Pharmacist-led opioid stewardship programs are also emerging, borrowing concepts from the established antimicrobial stewardship framework, reframing these concepts as required, and applying them to address the ongoing opioid crisis.[20,21] Stewardship roles have emerged in other areas as well, including anticoagulation management.[22] The concept of medication stewardship is an excellent example of clinical pharmacists applying advanced skills to move the pharmacist's role into new areas and to expand pharmacy's impact on clinical outcomes.

As mentioned above, ambulatory clinic settings are particularly well suited for advanced practice roles, particularly where pharmacists have independent prescribing authority.[3] However, even without prescribing authority, clinical pharmacists in clinic settings can be directly involved in initial decisions about treatment regimens in a proactive, team-based manner, working in conjunction with a physician specialist or a nurse practitioner.[23] Research indicates that clinic nurses and physicians generally support advanced pharmacist roles, including collaborative practice agreements, physical assessment, and prescribing authorities.[24]

Pharmacists in smaller community hospitals have implemented expanded scopes of practice, including applying various prescribing authorities (e.g., changing drugs within the same therapeutic class), independently titrating doses, and discontinuing medications.[25] Rural settings with limited access to comprehensive health care teams also offer many opportunities for pharmacists to step into more advanced clinical roles. For example, pharmacists can develop specialty practices in chronic disease management, present educational programs for a broad range of health care professionals, and participate in advanced cardiac life support.[26]

Unique examples of advanced pharmacy practices can be found outside traditional hospital and ambulatory settings. For example, the Canadian military provides many opportunities for advanced practice and innovative problem-solving by virtue of its high demands, limited resources, and close-knit team environment.[27] Military pharmacists are involved in a wide range of practice areas, including outpatient clinics, inpatient wards, and intensive care units. Specialized and complex pain management skills are particularly pertinent.

Other Countries

Hospital pharmacists in countries other than Canada have also had great success in advancing the profession of pharmacy, and they can provide unique perspectives. The *CJHP* series on pharmacists' roles in international health care systems, which concludes elsewhere in this issue,[28] offers numerous examples.

Penm and others[29] published an overview of the use of the International Pharmaceutical Federation's Basel Statements to assess and advance hospital pharmacy practice around the world. These statements provided the first unified global vision for hospital pharmacy practice, highlighting the need for skill development in diagnosis, physical assessments, and clinical decision-making, as well as the need for postgraduate prescribing courses for hospital pharmacists.

In his overview of the health care system in the United States, Scott described the governmental processes behind pharmacists being granted "provider status" in areas with shortages of health professionals.[30] For example, hospital pharmacists in several states have partial prescribing privileges, and some pharmacists working in federal Indian Health Service clinics have the role of primary care provider, and thus have prescribing privileges for both acute and chronic disease states.[30] Clinical pharmacy specialists in US Department of Veterans Affairs (VA) hospitals have taken on advanced roles, including increasing patient access to care by way of a shift from physician to pharmacist appointments for medication management.[31] Most VA hospitals utilize an advanced tool to document pharmacists' patient care activities, linking directly to patients' electronic medical records and providing valuable information on cost savings, quality, and patient outcomes. This information has been used for expanding the numbers of clinical pharmacy specialists and their roles.[31]

In the United Kingdom, the Royal Pharmaceutical Society Faculty provides the professional recognition program for advanced practice, which includes support networks, access to experts and mentors, opportunities for professional development, and portfolio development.[32] Advanced Pharmacy Framework competencies must be met and a portfolio submitted for review to receive postnominal titles aligned to a stage of practice.[32] Qualified independent pharmacist prescribers may prescribe autonomously for any condition within their clinical competence.[32]

Australia has piloted and implemented a credentialing system for advanced pharmacist practitioners to ensure that pharmacists are improving patient care and advancing the profession.[33] Candidates submit a practice portfolio for evaluation by a credentialing evaluator panel.[33,34] The 3 proposed levels for professional recognition are: L1 (Transition), L2 (Consolidation), and L3 (Advanced).[33,34] The following 5 recently adopted competency standard domains are components of the advanced practice framework: (1) expert professional practice, (2) professionalism and ethics, (3) communication and collaboration, (4) leadership and management, and (5) education and research.[33] Numerous specific standards and competencies are detailed under each domain.

Consultant pharmacists have lead roles in specialty clinics in Saudi Arabia, including anticoagulation clinics, cardiology, HIV, oncology, pain, solid organ transplant, and ambulatory care.[35] Qualifications include postgraduate year 1 and year 2 residencies, plus at least 3 years of relevant experience.[35] Collaborative practice agreements with physicians give these pharmacists prescriptive authority and allow them to order laboratory tests.[35] Government-funded scholarship training is expected to increase the number of pharmacists with these skill sets.[35]

Japan has a highly structured approach to credentialing and a board certification system with requirements in specialized knowledge, teaching, and research.[36] Although Japanese pharmacists cannot currently prescribe, they are involved in multidisciplinary teams in roles comparable to many advanced clinical roles in North American hospitals.[36]

There are undoubtedly many other examples of advanced pharmacist practices in other countries that could be used to illustrate current approaches and to collectively develop strategies for further advancing the profession.

Advanced Approaches to Teaching and Preceptorship

The clinical pharmacist's role includes a consistently increasing teaching responsibility in most academic settings; thus, innovative approaches to preceptorships for students and residents have advanced pharmacy practice in unique ways. Some key themes to these advancements include starting experiential education earlier in the curriculum, adopting new standards for learner-to-preceptor ratios, and expecting students to take increased responsibility for patient care activities after appropriate experience has been gained.[37,38] Not only have these changes required clinical pharmacists to adopt progressive approaches to advanced education, but they have also instilled fundamental skills that can be applied by new graduates as they work toward advanced practice roles.

Loewen and others[37] explored various models of preceptorship and found that grouping learners with one or more preceptors and including tiered learners were associated with several benefits for learners, including knowledge-sharing, social support, increased appreciation for teamwork, broader range of learning opportunities, and stronger independence. Preceptors reported decreased workload and reduced stress, as well as enhanced clinical and team management skills.[37] Hall and others[38] found that similar teaching models helped students to shift from their traditional roles as observers to more active roles as participants in patient care. This transformation included participation in patient care rounds with the constant supervision of a preceptor being replaced by daily supervision and tailored support. The approach allowed increased capacity for student learners. A review by Cameron and others[39] supported these conclusions and recommended peer-assisted and near-peer learning models as a way of promoting learning independence, thereby increasing motivation for teaching and facilitating targeted patient care activities into day-to-day student responsibilities. The University of British Columbia's Faculty of Pharmaceutical Sciences has implemented experiential education facilitator positions in part to promote nontraditional learner–preceptor models, with an emphasis on "student value".[40] These positions are cofunded by the faculty and the local hospital pharmacy departments. The goal is to provide optimal experiential education opportunities while allowing clinical pharmacist preceptors to continue their full clinical patient care assignments and to more effectively include real case examples in their preceptor activities.

EVIDENCE SUPPORTING ADVANCED PHARMACIST PRACTITIONER ROLES

Although the concept of the advanced pharmacist practitioner is relatively new and still evolving, there is some published evidence that advanced practitioners can have a beneficial impact on both patient outcomes and health care costs. Most studies have evaluated certain aspects of the specific activities outlined above, such as pharmacist prescribing or specific clinical roles; however, several studies have evaluated broader responsibilities. For example, the COLLABORATE study assessed the impact of a team-based pharmacist carrying out proactive clinical services, including medication history-taking, participation in multidisciplinary rounds, resolution of drug therapy issues, and discharge counselling.[41] Implementation of this pharmacist role resulted in improved overall quality of medication use (according to several prespecified indicators), as well as reduced readmission rates. Gillespie and others[42] evaluated comprehensive care provided by clinical pharmacists for patients over 80 years of age in a model that also included postdischarge follow-up. This approach resulted in reductions in overall health care costs, hospital visits, and drug-related readmissions. A study conducted in North Carolina evaluated a cohort of clinical pharmacist practitioners (CPPs) with prescribing authority to manage the care of referred patients.[43] These CPPs had undergone supplemental education and certification that included diagnosis and physical assessment training. Clinical efficacy and financial charges from referrals to the CPP were compared with cases managed by primary care providers (physicians, family nurse practitioners, and physician assistants),[43] with matching of patients by age, sex, and disease states. There were more outpatient visits but fewer emergency department visits (both of which were statistically significant differences) and a similar number of inpatient admissions in the CPP cohort relative to the primary care provider cohort. Patients with more complicated or refractory-to-standard-treatment conditions were more often referred to CPPs, which may have been a factor leading to the increase in outpatient visits. There was no difference in average daily medication costs or achievement of predetermined disease state goals. The authors concluded that CPPs provided comparable health care for patients with chronic conditions with respect to clinical efficacy and costs, and could relieve systemic pressures in areas with increased need for primary care practitioners. These are just a few examples of the evidence supporting the benefits of comprehensive care provided by clinical pharmacists in advanced practice settings.

FUTURE DIRECTIONS

A number of hospital pharmacy initiatives have been launched by professional societies to highlight and further develop pharmacy practices in a wide variety of settings. The CSHP "Excellence in Hospital Pharmacy" initiative aims to advance pharmacy practice through a 3-tiered approach focusing on patient engagement, best practice care plans, and effective collaboration.[44] The "Excellence Declaration" encourages pharmacists to implement "Excellence Initiatives", advancing practice to improve health outcomes. It encourages the sharing of success stories so that others can evaluate the potential to adopt these concepts and expand their own practices. The initiative aims to increase the uptake of specific advanced practice roles defined

by clear benchmarks, including prescribing authority, physical examination, and the ordering of diagnostic tests, among others. Interestingly, in a recent CSHP survey concerning this initiative, 57% of respondents reported that they were currently working in advanced practice roles.[44] CSHP's website also summarizes the Canadian consensus on clinical key performance indicators (KPIs).[45] This broad-based initiative, currently being piloted at several Canadian sites, is designed to collectively advance clinical pharmacy practice through the measurement and promotion of clinical KPIs to ensure that clinical pharmacists are focusing on evidence-based priorities.[46] The "Blueprint for Pharmacy" of the Canadian Pharmacists Association also outlines advanced practice goals, including establishing nationally accepted definitions for prescribing and administering drugs.[47] The associated "Vision for Pharmacy" includes goals to establish the ability of pharmacists to initiate, modify, and continue drug therapy, as well as to order lab tests.

Both the ASHP and the ACCP have been active in developing practice standards that promote the development and implementation of advanced pharmacist practitioner roles.[48,49] The ACCP states that its purpose "is to advance human health by extending the frontiers of clinical pharmacy".[48] It has outlined the fundamental clinical pharmacist competencies, including direct patient care, pharmacotherapy knowledge, systems-based care and population health, communication, professionalism, and continuing professional development.[48] The ASHP has also outlined various mechanisms for credentialing pharmacists, some of which promote expanded or enhanced practice competencies.[50] For many years, the Board of Pharmacy Specialties has offered specialty certification for pharmacists, with an increasing number of certifications now available, including pharmacotherapy, critical care, cardiology, infectious diseases, psychiatry, pediatrics, and ambulatory care.[51] Certifications for solid organ transplant and emergency medicine are planned over the next 2 years. Board certification is designed specifically to assess each participating pharmacist's qualifications for contributing to patient care "at advanced practice levels".

Jacobi and others[52] published a commentary in 2016 describing the goals of the ASHP Pharmacy Practice Model Initiative and its potential effect on future pharmacy practice. This initiative recommends that pharmacists be given prescribing authority as part of a collaborative practice team with the appropriate credentialing. It also recommends mandatory postgraduate training in direct patient care and expansion of the postgraduate year 2 residency program. However, although clinical specialists are necessary to advance practice, education, and research, the proposed model describes a pharmacy team of both generalists and specialists who share responsibility for delivering effective patient care. Future research is recommended to measure the impact of new practice models.

The ASHP Foundation's pharmacy forecast for 2018 included information to support hospital strategic planning in an effort to advance pharmacy practice toward specific areas in health care that are forecasted to influence health-system pharmacy over the next 5 years.[49] This forecast included a call for pharmacists to become "precision medicine experts and leaders" as more novel molecular entities are approved for use in North America. Advances in information technology will facilitate the use of statistical predictive models to improve clinical decision-making. This report also predicted the expansion of ambulatory care services, including opioid stewardship, with advanced roles for pharmacy technicians also being a forecasted priority. The forecast recommended education and training activities to support population health efforts, including "innovation centres" to improve various aspects of pharmacy practice.

Several Canadian surveys have evaluated pharmacists' opinions on the future directions of advanced practice skills and credentialing. Results from a review published in 2015 indicated that a large proportion of respondents would incorporate routine prescribing into their practice if permitted to do so by regulatory bodies.[53] Respondents also strongly supported a national specialty accreditation program, and most reported that they would strongly consider pursuing speciality recognition if this were available.[53] A study by Penm and others[54] conducted in 2015 also showed that the vast majority of those surveyed would support formal certification for pharmacy specialization leading to advanced practice roles. However, the authors also pointed out that unique specialties are not necessary to be considered advanced practices, and that pharmacists specializing in general areas such as pharmacotherapy may be considered "advanced generalists". In another study, Canadian hospital pharmacy residents predicted expanded roles for pharmacists by 2025, including prescribing independently, ordering laboratory tests, and administering medications, along with the associated responsibilities for monitoring patient outcomes.[55]

CONCLUSION

Many pharmacists are practising at advanced levels in a broad range of settings, and much is being written about future directions for our profession. The foregoing article is not an exhaustive review, and there are likely numerous other current and proposed roles that are good examples of pioneering work that further advances hospital pharmacy. There is clearly a need for further publications on this subject to provide more comprehensive information about the most recent practice examples and theories. The *CJHP* Editorial Board hopes that this new series on the Advanced Pharmacist Practitioner will provide relevant and applicable information to be shared and incorporated into the practices of all hospital pharmacists, including established clinicians, those just beginning their practice, and those currently studying to become hospital pharmacists. We anticipate that the series will run for about 2 years, with the next article focusing on advanced preceptorship concepts. Subsequent articles will

highlight specific examples of pharmacy practices, research innovations, applicable technological advances, pharmacist prescribing, and other yet-to-be-determined topics under this rapidly evolving theme. We encourage feedback, including your ideas for future publications within this series that will illustrate these concepts and provide background information to formulate new ideas for advanced practice initiatives.

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Transient Ischemic Attack in a High-Risk Cardiovascular Patient with Renal Dysfunction after Treatment with Rivaroxaban and Clopidogrel: A Case Report

Steven J Kary, Caitlin J Roy, William M Semchuk, and Andrea J Lavoie

INTRODUCTION

Patients with atrial fibrillation who have experienced acute coronary syndrome that was treated with percutaneous coronary intervention (PCI) represent a challenge in antithrombotic management, in terms of balancing the risks of thrombosis and bleeding. The 2018 update of the Canadian Cardiovascular Society's antiplatelet guidelines recommended triple therapy (an oral anticoagulant [OAC], a P2Y12 inhibitor, and acetylsalicylic acid [ASA]) with reduction in the intensity or dose of the OAC and consideration of dual therapy (OAC and P2Y12 inhibitor) within 1 day to 6 months after PCI following acute coronary syndrome.[1] In contrast, the 2016 atrial fibrillation guidelines of the Canadian Cardiovascular Society recommend triple therapy for 3 to 6 months after PCI in patients with stroke risk defined by a CHADS65 score of 1 or greater.[2] Triple therapy is associated with a 17.6% frequency of bleeding requiring hospitalization[2]; dual therapy has been proposed to reduce this risk of bleeding.

The PIONEER-AF-PCI and RE-DUAL-PCI trials assessed the safety of a direct OAC (DOAC) plus a P2Y12 inhibitor relative to the safety of triple therapy.[3,4] The PIONEER-AF-PCI trial (n = 2124 patients) demonstrated a reduction in clinically significant bleeding with rivaroxaban 15 mg dual therapy (or rivaroxaban 10 mg for patients with creatinine clearance of 30–50 mL/min) relative to triple therapy (16.8% versus 26.7%, respectively; $p = 0.002$).[3] In the RE-DUAL-PCI trial (n = 2725), dabigatran dual therapy was associated with a reduction in clinically relevant bleeding relative to triple therapy (for dabigatran 110 mg, 15.4% versus 26.9%, $p < 0.001$; for dabigatran 150 mg, 20.2% versus 25.7%, $p < 0.001$).[4] Although these safety outcomes are compelling, and there was no signal for loss of efficacy with dual therapy, these trials were underpowered to assess thrombosis outcomes.[3,4] Furthermore, high-risk populations, including patients with renal dysfunction, were underrepresented in these trials.

The case reported here represents the risks of applying evidence for DOAC dual therapy (with limited data for efficacy) to a high-risk cardiovascular patient with renal dysfunction.

CASE REPORT

An 82-year-old, 74-kg man with hypertension, dyslipidemia, coronary artery disease treated with PCI (16 years prior), deep vein thrombosis (17 and 21 years prior), and chronic renal insufficiency (baseline serum creatinine 140 µmol/L) was admitted in May 2017 for elective reverse total shoulder arthroplasty. The evening after surgery, while receiving ASA 325 mg daily, the patient experienced non-ST elevation myocardial infarction and acute-on-chronic renal injury (serum creatinine 185 µmol/L). A heparin infusion was started, along with clopidogrel 75 mg daily, and the ASA dose was changed to 81 mg daily. New-onset atrial fibrillation was identified on electrocardiography, and amiodarone was initiated. Hematoma of the right shoulder subsequently occurred, and the existing therapy was continued with close observation.

On day 2 after the surgery, the patient exhibited increased confusion and dysphagia; however, the findings of computed tomography (CT) were unremarkable. On day 6, aphasia and right hemiparesis occurred; CT showed an infarct in the left middle cerebral artery of suspected cardioembolic origin. The patient's symptoms recurred throughout the following week, with no changes on repeat CT; the acute renal injury resolved.

*The patient provided consent for publication of this case report.

On day 15, the patient was transferred to cardiac care for recurrent chest discomfort, with electrocardiography showing significant anterolateral ST depression. Coronary angiography revealed severe left main triple-vessel disease, which was treated with bare metal stents in the left main, ostial circumflex, and obtuse marginal arteries. Therapy with heparin, clopidogrel, and ASA was continued for 3 days after the procedure. On day 20 after the initial shoulder surgery, he was switched to rivaroxaban 10 mg and clopidogrel 75 mg daily, planned to continue for 1 year, as per the recommendations of the PIONEER-AF-PCI trial for a patient with creatinine clearance 40 mL/min (by weight-based Cockcroft–Gault equation, for serum creatinine 131 µmol/L) (CHADS65 = 4; bleed risk defined by HASBLED score = 3).[3] Renal function remained stable after PCI, and the patient did not experience repeat symptoms of stroke. The medications were continued at discharge on day 31.

On the day after discharge, the patient was readmitted with facial drooping, dysphagia, and right-side hemiparesis; CT showed no significant change. The diagnosis was recurrent transient ischemic attack, which prompted a switch to warfarin, with maintenance of the clopidogrel therapy (75 mg daily). The anti-Xa level calibrated for rivaroxaban was not measured, although steady-state drug concentrations were assumed. In follow-up with the neurologist in October 2017, it was noted that the patient continued to have infrequent episodes of aphasia, with subtherapeutic international normalized ratio (INR), following initiation of warfarin. This problem has since resolved, and the patient has not had recurrent stroke or transient ischemic attack, and subsequent INR values have been therapeutic.

DISCUSSION

The suitability of DOAC dual therapy for this high-risk patient is limited, as his medical conditions were not well represented in the available trials,[3,4] reducing the external validity of the efficacy outcomes. Given the small subset of patients with renal insufficiency in the trials, initial management with warfarin might have been more appropriate as a well-established option for stroke prophylaxis in patients with atrial fibrillation and declining renal function.

The 2 published trials of DOAC dual therapy would have excluded this patient because of risks of stroke and/or bleeding. More specifically, the PIONEER-AF-PCI trial[3] excluded patients with a history of stroke; in addition, 254 (35.8%) of the patients in the dual-therapy experimental arm were 75 years of age or older, and 130 (18.5%) patients had non-ST elevation myocardial infraction. One hundred and ninety-four (28.8%) of the patients had creatinine clearance of 30–60 mL/min; however, data for the subgroup with creatinine clearance of 30–50 mL/min, who would have received 10 mg rivaroxaban, were not published. The composite rate of death from cardiovascular causes, myocardial infarction, or stroke was 6.5% for patients receiving dual therapy versus 6.0% for those receiving triple therapy, although the study was underpowered to demonstrate significance for this comparison.[3] The primary composite safety outcome was significantly lower with dual therapy (16.8% versus 26.7%, $p = 0.002$), and was driven by bleeding that required medical attention (13.5% versus 19.9%, $p = 0.001$) rather than major or minor bleeding. Furthermore, the subgroup analysis of clinically significant bleeding for the rivaroxaban 10 mg group was not published. In the RE-DUAL-PCI trial,[4] patients with a stroke in the month before screening were excluded. Patients with previous stroke constituted 11% of the population, 16% had renal disease, the indication for PCI was unstable angina for 19.9% and non-ST elevation myocardial infarction for 20.7%, and the mean stroke risk defined by CHA_2DS_2-VASc score was 3.7 in the dabigatran 110 mg group.[4] The combined dabigatran 110 mg and 150 mg arms demonstrated non-inferiority for the composite end point of thrombosis, death, or unplanned revascularization relative to triple therapy (13.7% versus 13.4%, $p = 0.005$); however, this composite end point was higher for the dabigatran 110 mg arm (15.2% versus 13.4%, $p = 0.30$).[4] The primary composite safety outcome was significantly different between dual and triple therapy (for dabigatran 110 mg, 15.4% versus 26.9%, $p < 0.001$; for dabigatran 150 mg, 20.2% versus 25.7%, $p < 0.001$), which was maintained for the component of major bleeding (for dabigatran 110 mg, 5.0% versus 9.2%, $p < 0.001$; for dabigatran 150 mg, 5.6% versus 8.4%, $p = 0.02$); however, results for clinically relevant, nonmajor bleeding were not reported. It is unclear whether the outcomes of these trials, in terms of both efficacy and safety, can be extrapolated to similar patients of advanced age with a history of stroke and renal dysfunction.

Future trials may further elucidate the role of DOAC dual therapy. The AUGUSTUS trial (ClinicalTrials.gov identifier NCT02415400, completed November 2018) and the ENTRUST-AF-PCI trial (ClinicalTrials.gov identifier NCT02866175, estimated completion June 2019) are assessing the safety of apixaban and edoxaban dual therapy, respectively. Neither of these trials is assessing efficacy as a primary outcome, and application of their results to high-risk patients, such as the one described here, may be limited.

The patient described here was ultimately treated with warfarin-based dual therapy to balance his high risk of stroke with the risk of bleeding. In patients with high thrombotic risk, elevated bleeding risk, or a complex interplay of these 2 factors, ongoing critical evaluation of recent and emerging evidence is needed to determine optimal antithrombotic therapy.

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Does Measuring Serum Concentration of Procalcitonin in Critically Ill Patients Assist in Stopping Antibiotic Therapy?

THE "PRO" SIDE

Most successful debates start with a good understanding of the question at hand. We would like to begin the "pro" side of this debate by examining the question in detail. Like most diagnostic tests, the procalcitonin (PCT) test itself serves little purpose if not acted upon. In other words, for PCT monitoring to be helpful, it must possess characteristics that make it actionable. In addition, for the purpose of this debate, we will consider critically ill patients to be those who are treated in the intensive care unit and will ignore use of PCT measurement in the emergency department or other inpatient or outpatient settings. Lastly, reference to "stopping antibiotic therapy" signifies that an antibiotic has already been started. Simply put, the initial decision to start antibiotics has passed (independent of any quantification of PCT), and the decision now is whether the antibiotics can be de-escalated or discontinued. Such a change might occur because new clinical information and/or the PCT result has rendered obsolete the original decision to start antibiotics, or because the original infection has been adequately treated. In the remainder of this article, we will discuss in more detail the use of PCT measurement within the context of this question and provide recommendations on its most appropriate use. .

Is PCT Actionable?

More than a decade ago, PCT was deemed to be a "SMART" biomarker (*specific* and sensitive, *measurable* with precision, *available* and affordable, *responsive* and reproducible, and *timely*).[1] Today, PCT remains a SMART biomarker, with newer amplified cryptate emission assays having even greater sensitivity. The PCT concentration in serum is normally below 0.1 µg/L, but rises substantially in response to bacterial infections, endotoxins, and inflammatory cytokine.[1] Because the concentration peaks between 8 and 24 h after an insult and because PCT has an elimination half-life between 22 and 35 h, determining PCT concentration strikes the balance between having a measurable clinical window and ensuring responsiveness to treatments and disease progression.[1] At a cost of about Can$50 per assay, PCT measurement is less expensive than the daily charges for most antibiotics,[2] and is therefore a potentially cost-effective antimicrobial stewardship tool. For centres that have the platform to run PCT assays, the results can be readily available and actionable within several hours of sampling.

Many different PCT-guided treatment algorithms for stopping antibiotics exist. In a recent study by de Jong and colleagues,[3] patients admitted to the intensive care unit (ICU) with initiation of empiric antibiotics were randomly assigned to either PCT-guided treatment or usual care. For those in the PCT guidance group, PCT levels were obtained at baseline (within 24 h of antibiotic initiation) and daily until discharge from the ICU or 3 days after systemic antibiotics were stopped. The study protocol recommended that antibiotics be stopped if PCT concentration decreased by more than 80% from baseline or when the absolute value was less than 0.5 µg/L. This algorithm is straightforward and led to significant decreases in the duration of antibiotic therapy and also mortality at 28 days.[3]

Does PCT Monitoring Help in Stopping Antibiotics?

The short answer to the question in this heading is "yes"! At least 8 meta-analyses specifically evaluating critically ill patients have concluded that utilization of PCT monitoring is associated with shorter duration of antimicrobial therapy.[2,4-10] However, there are certain scenarios in which reliance on PCT values is not ideal. For example, use of elevated PCT level to justify initiation of antimicrobials or escalation of the antimicrobial spectrum of activity leads to overuse of antibiotics and potentially more end-organ dysfunction.[11,12] Hence, using PCT as a screening tool to initiate antibiotics or to broaden antibiotic coverage in the absence of signs and symptoms of infection cannot be recommended. Furthermore, in the initiation phase of antimicrobials, clinicians may not be inclined to withhold initial antibiotics. This was evident in a study by Layios and others,[12] in which samples for measurement of PCT were drawn when clinicians suspected infection. In that study, for cases in which baseline PCT was normal, only 36% of physicians were compliant with withholding antibiotics; in contrast, for patients with elevated baseline PCT, 86% of clinicians were compliant with continuing antibiotics. Hence, sampling PCT in the initiation phase is unlikely to overrule clinical judgment regarding antibiotics and may be more useful in the de-escalation phase of antimicrobial management. In fact, a recent meta-analysis specifically evaluated studies of PCT during the de-escalation phase, and concluded that both duration of antibiotic therapy (days) and short-term mortality were

significantly lower with PCT guidance when used for de-escalation purposes, but not when used for initiation of therapy or a mixture of the 2 approaches.[4]

How Should PCT Be Used?

No biomarker should be used in isolation for decision-making. Among critically ill patients, PCT monitoring should be part of a comprehensive antimicrobial stewardship program, with clinician guidance on how to interpret the test results. If the decision is made to initiate antibiotics and it is anticipated that PCT will be used for cessation decision-making, sampling for PCT should be completed at baseline purely for trending purposes. PCT level can be checked again on day 3 if clinicians are questioning the initial decision to initiate antibiotics (i.e., whether antibiotics should be continued). Beyond day 3, for patients whose condition is improving, PCT can be checked to determine whether the infection has been adequately treated. In both scenarios, the algorithm described by de Jong and others[3] is a reasonable approach, with recommendations to stop or de-escalate antibiotics when the absolute value of PCT is less than 0.5 µg/L or the PCT value has decreased at least 80% from baseline. When used for the de-escalation of antibiotics, PCT is consistently associated with reductions in antibiotic usage and may improve short-term mortality.

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THE "CON" SIDE

Procalcitonin (PCT) has grown in popularity recently as a surrogate marker for bacterial infection in patients with sepsis. After all, who would not want a test to guide the decision to stop or continue antibiotics in complex critically ill patients? The US Food and Drug Administration (FDA) approved PCT monitoring in 2017 to aid in the discontinuation of antibiotics in sepsis.[1] Despite this approval, the role of PCT monitoring has been under continued passionate debate. The mixed results of multiple meta-analyses assessing the outcomes of PCT monitoring are reflected in a weak recommendation from the Infectious Diseases Society of America, which lists serial PCT measurement as a tool to support discontinuation of antibiotics.[2] This situation has led to doubt about the preference for a surrogate marker over clinical judgment in critically ill patients.

The only predictable characteristic of PCT is its pharmacokinetics. Although it is believed that PCT can differentiate between bacterial and viral causes of systemic infection, a recent publication casts doubt.[3] In that study, higher PCT levels were correlated with the increased probability of a bacterial infection, but no PCT threshold was identified that reliably distinguished between a bacterial and a viral infection.[3] Overall, PCT is closely associated with, but is not specific for, infection; in essence, then, PCT measurement is similar to determining white blood cell concentration, but at much greater cost. Similar to the white blood cell count, PCT can be falsely elevated in patients with cardiogenic shock or a systemic inflammatory response to surgery, trauma, or burns. Falsely low values may be seen in localized infections and subacute endocarditis, or may occur if PCT is measured too early in the course of a systemic infection.[4] These limitations may affect the utility of PCT measurement in critically ill patients, whose antibiotic therapy may be started or stopped inappropriately.

Death is the most important outcome of any diagnostic or therapeutic strategy, but multiple meta-analyses of PCT monitoring

have reported mixed outcomes regarding the mortality benefit, depending on the design of the meta-analysis, the patient population assessed, and the role of PCT (for initiation or discontinuation of antibiotics, or both). This topic has been so popular that 5 meta-analyses of patients with sepsis in the intensive care unit (ICU) were published in 2017 and 2018.[5-9] Andriolo and others[5] limited their assessment to trials using strict definitions of sepsis, severe sepsis, or septic shock. They found no mortality difference at 28 days (risk ratio [RR] 0.89, 95% confidence interval [CI] 0.61–1.31) or at longest follow-up (RR 0.81, 95% CI 0.65–1.01), not even when less stringent trial criteria were used as part of the sensitivity analysis.[5] Two meta-analyses limited their analysis to trials assessing PCT evaluation for the purpose of cessation of antibiotics in critically ill patients. In both, there was a decrease in mortality: RR 0.86 (95% CI 0.76–0.98)[6] and RR 0.87 (95% CI 0.77–0.98).[7] The decrease in mortality may be due to their inclusion of a large randomized controlled trial (RCT) by de Jong and others.[10] Of the numerous RCTs evaluating PCT, this was the only RCT to show a mortality benefit (absolute difference 6.6%, 95% CI 1.3%–11.9%). The authors proposed that this benefit might be due to earlier identification of an alternative diagnosis.[10] However, the same reduced mortality was not seen in a meta-analysis created as part of a regulatory submission to the FDA,[8] despite inclusion of the de Jong trial. That meta-analysis assessed both patient- and study-level data, but did not show a reduction in mortality for either.[8] In a subsequent meta-analysis, Wirz and others[9] used only patient-level data and found a reduction in mortality (adjusted odds ratio 0.89, 95% CI 0.8–0.99). The bottom line is that most of these meta-analyses were analyzing the same RCTs, with outcomes that varied depending on how the analyses were structured. From these discordant mortality results, it is difficult to understand the true effect of the intervention. At most, we can say that the PCT-guided therapy did no worse than standard of care. However, given that there have been more meta-analyses published recently on this topic than RCTs, we must ask whether the answer is hidden in the data, or are we simply looking for an effect where none exists?

If a reduction in mortality cannot be found, then what about other outcomes? The biggest push for PCT monitoring has been based on reducing exposure to antibiotics as a means of reducing the potential for antimicrobial resistance. The meta-analyses cited above, regardless of design, all showed a decrease in duration of antibiotic use (by 1 or 2 days).[5-9] These results are not surprising, given the open-label trial designs and close assessment of patients in the intervention arms. Despite the positive results from individual RCTs and meta-analyses, real-world outcomes have been suboptimal. In a retrospective cohort study of 107 ICUs in the United States with PCT monitoring available, PCT-guided therapy led to an increase in antibiotic use (adjusted relative risk 1.1, 95% CI 1.15–1.18) with no difference in mortality (hazard ratio 1.05, 95% CI 0.93–1.19).[11] These results are concerning because of potential increases in costs and adverse effects.

If we just ignore the conflicting data and assume that the benefits of PCT monitoring outweigh its risks, one question remains: Will clinicians use PCT monitoring in their practice? The retrospective ICU cohort showed that PCT monitoring was ordered for only 18% of patients upon initiation of antibiotics for sepsis, and only 29.4% of these patients underwent subsequent measurement of PCT level.[11] Clinicians participating in RCTs were only slightly better in terms of their adherence to protocols: when compliance was measured, it was generally poor.[10,12-14] Even in the largest trial, almost half of the clinicians chose to overrule the discontinuation guidelines unless the patient was clinically stable.[10] Perhaps noncompliance is due to the lack of validation of clinical decision algorithms for use of PCT monitoring to discontinue antibiotics in sepsis. PCT thresholds in sepsis trials have been heterogeneous with respect to cut-off values, percent changes from baseline, and monitoring strategies. Before PCT monitoring can be confidently implemented and interpreted by clinicians, further studies are needed to prospectively validate cut-off thresholds. After all, why order a test if you do not know what to do with the results?

Although there is no perfect biomarker for sepsis, it is unclear what value monitoring PCT adds to clinical judgment that would offset the cost of this expensive test. It has the potential for overutilization and increased costs, and is limited by inadequate clinician response or acceptance of results. The proposed mortality benefit is cause for excitement, but should be interpreted cautiously, given that it has been observed in only one clinical trial. Overall, although the intentions of using PCT monitoring are generally favourable, the evidence has remained controversial and the jury is still out on the benefits. Next time you want to order a PCT monitoring test … just look at the white blood cell count instead and use your clinical judgment.

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ON THE FRONT COVER

Banff, Alberta

Grace Lin took the cover photo while attending the CSHP Banff Seminar in March 2012. "Looking into the mountain ridges with the melting snow brought joy to my heart on a beautiful spring day." Grace captured the image with a Canon Rebel XS, her first digital DSLR camera. In addition to photography, Grace also dabbles in painting as a hobby. She has been practising as a hospital pharmacist since 2007 and is currently employed with Lions Gate Hospital in Vancouver.

The *CJHP* would be pleased to consider photographs featuring Canadian scenery taken by CSHP members for use on the front cover of the Journal. If you would like to submit a photograph, please send an electronic copy (minimum resolution 300 dpi) to publications@cshp.pharmacy.

Biological Monitoring of 4 Antineoplastic Drugs in Health Care Workers from 2 Adult Hospitals: A Pilot Study

Up to 75 000 Canadian workers are exposed to antineoplastic drugs, especially pharmacists, pharmacy technicians, and nurses.[1] Adverse effects include risk of genotoxicity (evidenced by increases in genotoxicity biomarkers), reproductive risks (congenital malformations, miscarriages), and cancers.[2,3] Canadian and US guidelines recommend environmental monitoring.[4-7] Biological monitoring is mainly used in research settings, but could also help to confirm whether workers are free of contamination.

In a previous pilot project conducted in a mother–child hospital,[8] no contamination was found in the urine of 101 workers tested. Although this finding was reassuring, it is recognized that results from a single centre may not be representative, especially given the lower doses prepared and the different drugs used for pediatric populations. We therefore sought to evaluate the feasibility of additional study and to explore potential differences for workers in adult care settings.

The study was conducted in 2 adult health care centres (750 beds [including 30 oncology beds] and 700 beds [including 28 oncology beds], respectively). Neither of the centres used closed-system drug transfer devices for compounding or administration of drugs. At one centre, all vials were washed upon receipt from the manufacturer; at the other centre, some vials were washed upon receipt. At one centre, IV tubing was primed in the pharmacy; at the other centre, IV tubing was primed by nurses on the various health care units.

The study protocol was approved by both institutional review boards in 2016. During the prestudy period, information sessions were presented (in January and June 2017, respectively) to describe the study and to increase workers' awareness and knowledge of the risks involved in working with antineoplastic drugs.

Workers who agreed to participate in the study provided informed consent. Each worker documented tasks performed and associated use of personal protective equipment by filling out a diary over a period of 5 days (the sampling day and the preceding 4 days). For each worker, 1 urine sample was collected in a 100-mL polypropylene container at the end of the work shift. Samples were kept at –20 °C and were later analyzed for cyclophosphamide (limit of detection 9.0 pg/mL), ifosfamide (limit of detection 9.7 pg/mL), methotrexate (limit of detection 75 pg/mL), and α-fluoro-β-alanine (FBAL, the main urinary metabolite of 5-fluorouracil; limit of detection 120 pg/mL). Drugs were quantified in positive electrospray multiple-reaction monitoring mode by ultra-performance liquid chromatography tandem mass spectrometer (Waters Xevo TQ-S system) by staff of the Centre de toxicologie du Québec. Pooled data are presented. The detailed method was published previously.[8]

Samples were collected in January and February 2017 at one centre and in June 2017 at the other centre. Twenty-eight workers were recruited at each centre, for a total of 56 participants (15 pharmacy technicians, 17 pharmacists, and 24 nurses). Most participants (54/56) had worked in hematology–oncology on the sampling day, and almost as many (49/56) had also worked in this setting on the previous day. Most participants were women (51/56), 41 participants were between 30 and 49 years of age, and overall the participants had worked a mean of 6.5 years (standard deviation 5.8 years) in oncology. Most of the nurses (23/24) had worked in the outpatient clinic on the sampling day, and 3 had also worked with inpatients. All of the pharmacists and pharmacy technicians worked in the oncology pharmacy. Half of the pharmacists (9/17) had visited inpatients on the day before sampling or on the sampling day.

The tasks related to antineoplastic drugs that were performed by participants are listed in Table 1. One technician reported a slight spill on his gloves; no other incidents related to antineoplastic drugs were reported. None of the participants reported any difficulties or concerns regarding their participation in the study.

Most workers wore at least gloves for the majority of activities related to handling antineoplastic drugs (Table 2). The pharmacy technicians more often wore other personal protective equipment in addition to gloves. However, for some activities, such as storing vials, working in offices, transporting drugs, flushing the IV tubing, and other nontechnical activities, some workers wore no protection.

None of the 56 urine samples had any detectable concentrations of any of the 4 drugs.

This pilot project was successfully implemented in 2 adult health care centres. The results were similar to those previously obtained in a mother–child centre.[8] No workers had detectable concentrations of antineoplastic drugs in their urine after their work shift. A wide variety of tasks were performed. Although gloves were frequently worn, many workers reported not wearing personal protective equipment. We suggest that whenever biological monitoring is conducted, it should be accompanied by information sessions for the workers, to remind them of safe handling practices and the use of protective equipment.

The absence of contamination in the urine of workers from these 2 adult centres can be explained by good handling practices, low surface contamination, the regular use of gloves, and the fact

Table 1. Potential Exposure to 4 Antineoplastic Drugs (Cyclophosphamide, Ifosfamide, Methotrexate, and 5-Fluorouracil)

Profession and Source of Exposure	Timing of Exposure	Mean ± SD or Total No.*
Pharmacy technicians (*n* = 15)		
Time in oncology setting (hours) (mean ± SD)	On sampling day	7.0 ± 1.7
	On day before sampling	5.0 ± 3.7
No. of vials handled	On sampling day	53
	On day before sampling	33
No. of preparations compounded	On sampling day	30†
	On day before sampling	23
Pharmacists (*n* = 17)		
Time in oncology setting (hours) (mean ± SD)	On sampling day	7.2 ± 2.0
	On day before sampling	7.0 ± 2.6
No. of patients seen during rounds	On sampling day	10
	On day before sampling	29
No. of preparations validated	On sampling day	57‡
	On day before sampling	81
No. of preparations packaged	On sampling day	41‡
Nurses (*n* = 24)		
Time in oncology setting (hours) (mean ± SD)	On sampling day	7.1 ± 2.2
	On day before sampling	7.4 ± 1.6
No. of IV tubing connections	On sampling day	45
	On day before sampling	34
No. of IV tubing disconnections	On sampling day	25
	On day before sampling	19

SD = standard deviation.
*Single values represent the total number for all personnel in each category.
†The 30 preparations entailed the following total amounts of drugs prepared on the sampling day: ifosfamide 0 mg, methotrexate 555 mg, cyclophosphamide 15 050 mg, and 5-fluorouracil 39 685 mg.
‡The 57 preparations validated and the 41 preparations packaged entailed the following total amounts of drugs validated and packaged on the sampling day: ifosfamide 2701 mg, methotrexate 536 mg, cyclophosphamide 27 640 mg, and 5-fluorouracil 155 385 mg.

that both centres have participated in environmental monitoring studies for many years, such that workers from these centres may have increased awareness of the risks associated with antineoplastic drugs.

Four drugs with differing half-lives (ranging from about 2 to about 10 h) were used in the study centres and tested in this pilot study. It is not possible to identify a single point during a shift when a worker is exposed to antineoplastic drugs; rather, exposure to small amounts likely occurs throughout the day. Identifying a single sampling method that would be optimal for all drugs and all workers is potentially challenging. Spot urine sampling at the end of a shift was chosen previously to evaluate a convenient and cost-effective method that could become part of a national program.[8] Similar results were obtained in 2 studies that implemented routine monitoring programs with spot urine sampling, one in Italian hospitals (0% positive samples)[9] and one in French hospitals (4% positive samples).[10]

Although spot sampling is less cumbersome and less costly, 24-h sampling covers a longer span of time and might increase the chances of finding contamination, if present. However, a longer sampling period might not be needed if the intention is to perform routine evaluation in a specified work setting. Both methods have been used previously by research groups from many countries, but the results have not been formally compared. Maeda and others[11] found no positive urine samples with either 24-h sampling or spot sampling. In their recent study, Koller and others[12] found no urine samples testing positive for cyclophosphamide or 5-fluorouracil with spot pre-shift and post-shift sampling for 5 consecutive days. Conversely, Sabatini and others[13] found that up to 36% of workers had positive urine samples (with spot sampling). However, the rate of contamination declined to 0% over time,[13] a finding similar to that of Sottani and others[14] (who also used spot sampling). Using 24-h sampling, another Canadian group found that 55% of urine samples tested positive.[15] Thus, we cannot know with certainty whether the results of the current study would have been different if a different sampling method had been used.

No issues of concern were reported by pharmacy technicians, pharmacists, and nurses participating in this study, which is a good indication that a national monitoring program would be feasible. For this exploratory study, workers were briefed before their participation. We recruited centres that performed regular environmental monitoring and that expressed an interest in this topic, so the results may not be representative of all Canadian centres.

In conclusion, none of the workers evaluated in 2 Canadian adult health care centres had detectable concentrations of

Table 2. Self-Reported Use of Personal Protective Equipment (PPE) When Performing Tasks with Antineoplastic Drugs

Profession and Task	Type of PPE; No. (%) of Tasks					
	Gloves + Other PPE		Gloves Only		No PPE	
Pharmacy technicians						
Receipt of drugs	6/9	(67)	1/9	(11)	2/9	(22)
Storage or drugs	4/10	(40)	4/10	(40)	2/10	(20)
Nonsterile compounding	1/1	(100)	0/1	(0)	0/1	(0)
Sterile compounding	7/7	(100)	0/7	(0)	0/7	(0)
Cleaning (vials, hoods, surfaces, pass-through)*	30/34	(88)	3/34	(9)	1/34	(3)
Waste disposal*	13/13	(100)	0/13	(0)	0/13	(0)
Pharmacists						
Working in office	0/15	(0)	4/15	(27)	11/15	(73)
Working at the hood workstation	4/13	(31)	5/13	(38)	4/13	(31)
Cleaning a surface	1/2	(50)	1/2	(50)	0/2	(0)
Waste disposal*	1/3	(33)	2/3	(67)	0/3	(0)
Nurses						
Transporting drug†	3/22	(14)	6/22	(27)	12/22	(55)
Connecting IV tubing	9/23	(39)	13/23	(57)	1/23	(4)
Disconnecting IV tubing	8/23	(35)	13/23	(57)	2/23	(9)
Flushing IV tubing	2/23	(9)	7/23	(30)	14/23	(61)
Administering drug	11/23	(48)	11/23	(48)	1/23	(4)
Cleaning a surface	1/20	(5)	18/20	(90)	1/20	(5)
Waste disposal	13/23	(57)	8/23	(35)	2/23	(9)
Nontechnical activities*	0/24	(0)	14/24	(58)	10/24	(42)

*Some tasks were pooled. For each task, the denominator represents the total number of times all of these tasks were performed by all workers who reported the tasks.
†One nurse reported using only a protective gown.

4 antineoplastic drugs in their urine. This absence of detectable contamination in exposed workers contrasts with the findings of other researchers, who have reported such contamination, and is a good indication of the effectiveness of measures in place in the 2 study centres. Further research is needed to evaluate the need for biological monitoring and to optimize the method before routine monitoring is offered outside the research context. Future studies will focus on determining the optimal time of sampling and eventually establishing whether there is a threshold amount of contamination that can be tolerated. Workers need to be reminded of the importance of wearing all recommended protective equipment to reduce their risk of adverse health effects.

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Tribute to the Reviewers of the *Canadian Journal of Hospital Pharmacy*

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2019 CSHP National Awards Program Winners
Programme national des prix 2019 de la SCPH : lauréats et lauréates

The winner of the **Distinguished Service Award** (sponsored by Pharmascience Inc.) is **Moira Wilson** (Saint John, NB).

The winner of the **Isabel E. Stauffer Meritorious Service Award** (sponsored by Fresenius Kabi Canada Ltd.) is **Diane Brideau-Laughlin** (Moncton, NB).

The winner of the **New Hospital Pharmacy Practitioner Award** (sponsored by SteriMax Inc.) is **Laura V Minard** (Halifax, NS).

The winner of the **Hospital Pharmacy Student Award** (co-sponsored by the Canadian Society of Hospital Pharmacists [CSHP] and the Canadian Association of Pharmacy Students and Interns [CAPSI]) is **Sydney Evans** (Riverview, NB).

Patient Care Enhancement Award
Sponsored by **Teva Canada Limited**
Benzodiazepine and Sedative-Hypnotic Drug Use in Nova Scotia Hospitals: A Point Prevalence Survey (completed at Nova Scotia Health Authority)
Heather L Neville, Mia Losier, Jennifer Pitman, Melissa Gehrig, Jennifer Isenor, Laura V Minard, Ellen Penny, Susan K Bowles

Pharmacotherapy Best Practices Award
Sponsored by **Pfizer Canada ULC**
Voriconazole Prophylaxis in Leukemic Patients: A Retrospective Single Centre Study (completed at Sunnybrook Health Sciences Centre)
Vivian Bui, Sandra A N Walker, Marion Elligsen

Safe Medication Practices Award
Sponsored by **Health*PRO* Procurement Services Inc.**
Retrospective, Multicentre Matched Cohort Study Comparing Safety and Efficacy Outcomes of Intermittent Infusion and Continuous Infusion Vancomycin (completed at Sunnybrook Health Sciences Centre)
Nathan H Ma

Teaching, Learning and Education Award
Sponsored by **Pfizer Canada ULC**
Development of a Vancomycin Competency-Based Training and Assessment Program (VC-TAP) (completed at Saskatchewan Health Authority, Saskatoon Area)
Meagan Rieger, Barb Evans, Justin Kosar

The award-winning abstracts are published exactly as submitted by the authors and have not undergone any copyediting by the Canadian Journal of Hospital Pharmacy. *Le J*ournal canadien de la pharmacie hospitalière *n'a pas soumis les résumés primés à une révision linguistique et les publie ici tels que remis par les auteurs.*

Benzodiazepine and Sedative-Hypnotic Drug Use in Nova Scotia Hospitals: A Point Prevalence Survey

Patient Care Enhancement Award, sponsored by Teva Canada Limited

Neville HL[1], Losier M[1,2], Pitman J[1,2], Gehrig M[1], Isenor JE[2], Minard LV[1], Penny E[1], Bowles SK[1,2]
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Background: Benzodiazepines and sedative-hypnotic drugs (BZD/SHDs), such as zopiclone and the antidepressant trazodone, pose a number of risks such as falls, fractures, and confusion, especially in older adults. Use of these drugs is poorly understood in the acute care setting.

Objectives: To determine the point prevalence and characterize use of BZD/SHDs in Nova Scotia hospitals with ≥ 30 acute care beds.

Methods: A point prevalence survey (PPS) was conducted by reviewing the health records of adults admitted to hospital between May and August 2016. The number of patients who received a BZD/SHD within the 24 hours prior to the start of the survey was divided by the total number of patients admitted to each ward to determine prevalence. Exclusions were patients < 18 years of age, drugs given by the intravenous route, and patients in long term care, mental health, addiction treatment, or critical care. Results were summarized descriptively.

Results: All 16 eligible hospitals participated in the PPS. The overall prevalence of BZD/SHD use was 34.6% (487/1409) and ranged from 15.6-56.3%. The average age of patients who received a BZD/SHD was 70.3 years, 30.8% of patients were ≥ 80 years of age, and 54.6% of patients were female. The most commonly used drugs included zopiclone (32.0%), lorazepam (21.9%), trazodone (21.9%) and clonazepam (11.3%). Top indications for use were bedtime/daytime sedation (60.0%) and anxiety (12.5%). In 17% of cases the indication could not be determined. Over half (55.7%) of the medications had been initiated at home and continued in hospital, the remainder were started in hospital (37.6%), or unknown (6.7%).

Conclusions: BZD/SHDs were frequently used by hospitalized patients in Nova Scotia. Areas identified for quality improvement included decreasing the use in older adults, preventing inappropriate initiation of BZD/SHDs in hospital, and improving the documentation of indications for BZD/SHD use.

Keywords: benzodiazepines, sedative-hypnotic drugs, hospital, drug safety, geriatrics, sleep

Voriconazole Prophylaxis in Leukemic Patients: A Retrospective Single Centre Study

Pharmacotherapy Best Practices Award, sponsored by Pfizer Canada ULC

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**Senior author, now retired (affiliations at time of study completion)*

Background: Invasive fungal infections (IFIs) commonly occur in acute myeloid and lymphoblastic leukemia (AML and ALL) patients receiving chemotherapy. In these patients, posaconazole prophylaxis is recommended; however, voriconazole may be a less costly alternative. The objective of this study was to evaluate the efficacy and safety of voriconazole prophylaxis in acute leukemia patients.

Methods: A retrospective chart review of inpatients at Sunnybrook Health Sciences Centre between 2005 and 2017 was completed. Hospitalized adult AML and ALL patients who received voriconazole prophylaxis (cases) were compared to patients who received fluconazole or no prophylaxis during chemotherapy (controls). Statistical analyses comparing baseline characteristics, safety, and efficacy outcomes between the study cohorts were completed; and a generalized estimating equation (GEE) was used to balance for any observed baseline differences and / or the effect of repeat patient admissions. A posaconazole literature-based weighted mean risk was compared to the voriconazole risk of IFI identified in this study with patients who had similar characteristics, including: age and primary diagnosis.

Results: Of 490 AML or ALL patients, 83 controls and 92 cases were eligible. Case patients received an average of 24.4 ± 10.8 days of voriconazole prophylaxis. The GEE confirmed incidence of proven or probable IFIs with voriconazole was 3.3% (3/92) versus 7.2% (6/83) in the control cohort (GEE OR 0.43; 95% CI -2.3-0.6; p>0.05) and was comparable to the literature reported weighted incidence of IFI with posaconazole (2.4 ± 2.1%; 95% CI 1.3-3.4%; p>0.05). Voriconazole was well tolerated by patients (91%; 84/91; 7 discontinued due to asymptomatic elevated liver function tests).

Conclusions: Voriconazole prophylaxis was found to be safe, effective, and comparable to literature based efficacy data for risk of IFI with posaconazole antifungal prophylaxis in patients with acute leukemia undergoing chemotherapy; and could represent a significant cost advantage.

Retrospective, Multicentre Matched Cohort Study Comparing Safety and Efficacy Outcomes of Intermittent Infusion and Continuous Infusion Vancomycin

Safe Medication Practices Award, sponsored by HealthPRO Procurement Services Inc.

Ma N[1,2], Walker SAN[1,2,3,4], Elligsen M[1], Palmay L[1], Ho G[5], Leis JA[3,4,6], Bansal V[7], Powis J [5,6]*
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**Senior author, now retired (affiliations at time of study completion)*

Background: Patients with good renal function receiving intermittent infusion vancomycin (IIV) may require total daily doses ≥4g to achieve trough concentrations of 15-20mg/L, increasing the risk of vancomycin associated nephrotoxicity (VAN). Continuous infusion vancomycin (CIV) may enable attainment of target concentrations with a lower daily vancomycin dose, potentially reducing the risk of VAN.

Objectives: The primary objective was to compare VAN risk (serum creatinine [sCr] increase ≥50% from baseline) and renal damage (sCr increase ≥100% from baseline) in patients receiving IIV versus CIV. The secondary objective was to compare clinical cure between IIV and CIV in patients with vancomycin trough or steady state concentrations of ≥12mg/L, respectively.

Methods: Retrospective chart reviews for eligible inpatients at Sunnybrook Health Sciences Centre; Holland Orthopaedic and Arthritic Centre; St. John's Rehab and Michael Garron Hospital between January 1, 2010 and December 31, 2016 were completed. Adult inpatients who received ≥48 hours of vancomycin with ≥1 steady state vancomycin concentration were eligible. Baseline patient characteristics, safety and efficacy outcomes for the IIV and CIV cohorts were compared using appropriate statistical tests (Fisher's exact, Student's t-test, or Mann-Whitney), with significance defined as P<0.05. A generalized estimating equation model was used to identify independent predictors of VAN.

Results: Of 2136 patients who received vancomycin during the study period, 146 CIV patients were eligible and matched to 146 IIV patients. CIV was found to have a lower odds of developing nephrotoxic risk (odds ratio [OR] 0.42, 95% confidence interval [CI] 0.21-0.98, p=0.025) and renal injury (OR 0.19, 95% CI 0.05-0.59, p=0.004). There was no difference in clinical cure between IIV (62/67 [93%]) and CIV patients (58/62 [94%]; P>0.99).

Conclusion: CIV patients were less likely to experience nephrotoxic risk and renal damage. The results indicate there is no difference in clinical cure between patients who received IIV versus CIV.

Keywords: vancomycin, intermittent infusion, continuous infusion, safety, efficacy

Development of a Vancomycin Competency-Based Training and Assessment Program (VC-TAP)

Teaching, Learning and Education Award, sponsored by Pfizer Canada ULC

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[1]Pharmacy Services, Saskatchewan Health Authority, Saskatoon, SK
[2]College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, SK

Background: Competency based education focuses on the knowledge, skills and attitudes required to be competent in an area. Currently, hospital pharmacists in Saskatoon receive training for vancomycin; however, competency is not measured.

Objectives: 1) Obtain Saskatoon pharmacists' views on the current training module, existing knowledge gaps, and components of a competency-based training program, 2) define competencies for managing patients on vancomycin, 3) create a vancomycin pharmacist competency rubric and assessment tool, 4) develop vancomycin education modules, and 5) survey pharmacists for feedback on the education modules and future program development.

Methods: Focus groups were conducted to identify what an ideal vancomycin training program would constitute. Competencies and a rubric with accompanying formative feedback form were created using existing standards, focus group discussions, and local expert opinions. Pharmacists were invited to listen to education modules, adapted from the previous vancomycin training PowerPoint®, and then provide feedback on strengths, perceived gaps and future program development.

Results: Several competencies were defined for pharmacists monitoring patients on vancomycin therapy. The rubric and formative feedback form used the Dreyfus Skill Acquisition rating scale to evaluate pharmacists during initial and continued management of vancomycin. Four vancomycin e-learning modules were created discussing 1) pharmacology and adverse effects, 2) nomograms, dosing, and administration, 3) therapeutic drug monitoring, and 4) dosing in special patient populations. Overall, 29.7% of hospital pharmacists in Saskatoon completed the education modules and survey. The survey indicated the modules were long but had good content and were well presented.

Conclusions: The rubric, formative feedback form, and education modules have been developed for vancomycin competency-based training and assessment program (VC-TAP). Further study will be required to determine the program's impact on pharmacist competency when dosing and monitoring patients on vancomycin.

Keywords: Competency-based education, pharmacist, vancomycin

CSHP Professional Practice Conference 2019: Poster Abstracts / Conférence sur la pratique professionnelle 2019 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 3, 2019 • Dimanche 3 février 2019

Infectious Diseases / Antimicrobial Stewardship

1. Improving Management of *Clostridium difficile* Infection by Direct Notification to Pharmacists
2. Development and Evaluation of an Infectious Diseases Education Program for Pharmacists
3. Sustaining Antimicrobial Stewardship Program in an ICU over More than 5 Years: Enabling ICU Pharmacy Practice
4. Determination of Antibiotic Susceptibilities in *Aerococcus urinae* Urinary Isolates
5. An Evaluation of Daptomycin Prescribing and Clinical Outcomes: A Retrospective, Single-Centre Experience

Precepting / Teaching

1. Determining Key Quality Assurance Indicators for Advanced Pharmacy Practice Experiences Placement Site Visits
2. Preceptor Experiences with Novel Student-Preceptor Models in Pharmacy Education: A Qualitative Analysis
3. Development of a Baseline Assessment Tool for Pharmaceutical Care Knowledge and Skills for Incoming Pharmacy Residents
4. Virtual Patients: Bridging the Gap between the Classroom and Clinical Pharmacy Practice
5. Atlantic Canadian Hospital Pharmacists in Direct Patient Care: Experiences as Preceptors

Medication Safety / Adverse Drug Events

1. Real-Time Tracking of Nursing Requests for Missing Medications
2. Kratom-Induced Acute Liver Failure
3. Autoimmune Hepatitis after Receiving One Cycle of Nivolumab/Ipilimumab
4. Characterization of Medication-Related Near Miss Safety Events
5. Incidents Associated with Centralized Automated Processing of Multi-Medication Compliance Packs

Drug Stability and Sterility

1. Chemical Stability of Cloxacillin in Sterile Water for Injection (SWFI) Stored in Polypropylene (PP) Syringes (50 and 100 mg/mL) and Glass Vials (250 mg/mL) at 4°C and 25°C
2. Stability of 1.0, 0.2 and 0.025 mg/mL Milrinone Solutions Stored in Syringes at 4°C and at Room Temperature (25°C)
3. Stability of Magnesium Sulphate Solutions in PVC Minibags, Non-PVC Minibags, and Polypropylene Syringes Stored at 4°C
4. Stability of Cardioplegia Additive Solution in Polyvinyl Chloride Bags Stored at 4°C for 9 Days
5. Review of Microbial Contamination of Vials Used for Compounding with Closed System Drug Transfer Devices

Clinical Pharmacy Practice

1. Estimating the Proportion of Emergency Department Visits That Can Be Managed by Pharmacists' Expanding Scope in Ontario between 2010 and 2017
2. The Impact of Pharmacist Medication Management on 30-Day Hospital Re-Admission Rates as a Member of a Rapid Response Transitional Team
3. Do Knowledge Gaps about Opioids Exist for Pharmacists? A Closer Look at a Novel Online Learning Platform
4. Pharmacist Medication Reviews via Videoconference: A Prospective Cohort Study Pilot Study in Remote and Rural Underserviced Communities
5. Implementation of Electronic Special Access Program Forms to Improve Workflow for Pharmacists

Pharmacy Administration / Drug Distribution

1. Use of Extensive Auditing to Reduce Potential Diversion of Narcotics and Controlled Drugs in a Healthcare Facility
2. An Analysis of Medication Returns to Inpatient Pharmacy Using a Closed-Loop Health Information System
3. Utilization of the Electronic Health Record to Minimize Pharmacy Alert Fatigue
4. An Assessment of the Cost-Effectiveness of 24/7 Hospital Pharmacy
5. Identification and Selection of Preferred Candidates for the Position of Chief Executive Officer of a Professional Association

Pharmacotherapeutics

1. Comparison of Preventive Cardiovascular Pharmacotherapy in Surgical versus Percutaneous Coronary Revascularization
2. The Utilization of Mineralocorticoid Receptor Antagonists in Patients with Post ST-Elevation Myocardial Infarction Complicated by Left Ventricular Dysfunction
3. An Assessment of Modifiable Risk Factor Management in Hospitalized Patients with Type 2 Diabetes Mellitus
4. The Antithrombotic Treatment of Patients with Atrial Fibrillation Undergoing Percutaneous Coronary Intervention
5. A Retrospective, Observational Study of the Management of Patients Hospitalized with Heart Failure with Reduced Ejection Fraction

Monday, February 4, 2019 • Lundi 4 février 2019

Infectious Diseases / Antimicrobial Stewardship

1. Evaluation of a Pharmacist-Led Antimicrobial Stewardship Service in a Pediatric Emergency Department
2. Evaluating the Impact of Prospective Audit and Feedback on the Use of Clindamycin and Quinolones in Clinical Teaching Units
3. A Retrospective Analysis of the Management of *Staphylococcus aureus* Bacteremia
4. Process Measures Associated with a Successful Antimicrobial Stewardship Intervention to Stop a *Clostridium difficile* Outbreak

Medication Safety / Adverse Drug Events

1. Severe Allergic Reaction Induced by Dexlansoprazole: A Case Report and Literature Review
2. Environmental Contamination with Nine Antineoplastic Drugs in 79 Canadian Centers
3. Adverse Effects of High-Dose vs Standard-Dose Dexmedetomidine in the Cardiac-Surgery Population: A Retrospective Cohort Study
4. Capturing Medication Safety Culture in Saskatchewan Pharmacies Using the Medication Safety Culture Indicator Matrix
5. Analyse descriptive des incidents et accidents médicamenteux de 2011 à 2018 dans un centre hospitalier

Clinical Pharmacy

1. Comparative Evaluation of Intentional versus Unintentional Medication Discrepancies during Admission Medication Reconciliation
2. Transition of an Independent Website for a Professional Association Branch to a Microsite Integrated within the Website of the Parent Organization
3. Opioid Stewardship: Implementing Proactive, Pharmacist-Led Reviews for Patients Co-Prescribed Opioids and Benzodiazepines at an Urban Academic Family Health Team
4. Optimizing Patient Education of Oncology Medications: A Quantitative Analysis of the Patient Perspective
5. Development of Candidate Choosing Wisely Recommendations for a Professional Society

Pharmacy Administration / Drug Distribution

1. The Impact of Delisting Docusate from a Hospital Formulary
2. Pharmacist Review of Computer Physician Medication Order Entry in Hospitals: A Prospective Observational Study of Pharmacist Interventions
3. Determining Patient and Caregiver Values and Needs from an Outpatient Oral Anticancer Therapy Program: A Qualitative Needs Assessment
4. Telepharmacist Medication Order Review: A Prospective Observational Study in Healthcare Systems
5. Patients' Perspectives on a Self-Administration of Medication Program in a Rehabilitation Hospital

Tuesday, February 5, 2019 • Mardi 5 février 2019

Infectious Diseases / Antimicrobial Stewardship (1)

1. Clinical Burden of Antibiotic Resistance Following Implementation of a Multidisciplinary Antimicrobial Stewardship Initiative in a Major Tertiary Care Center: A Controlled Interrupted Time Series Analysis over 14 Years
2. Ceftobiprole plus Vancomycin for the Treatment of Methicillin-Resistant Staphylococcus Aureus Infective Endocarditis: Case Report
3. Antimicrobial Guideline Concordance is Low in Cancer Patients with Febrile Neutropenia Admitted to General Internal Medicine at an Academic Hospital
4. Drug Utilization Evaluation of Ceftolozane/Tazobactam in a Canadian Academic Teaching Hospital System
5. A Retrospective Case Series Assessing Ceftolozane/Tazobactam Use at a Large Academic Centre

Infectious Diseases / Antimicrobial Stewardship (2)

1. Using Monte Carlo Simulation to Evaluate Tigecycline Dosing Strategies for Bacteria with Raised Minimum Inhibitory Concentrations in Non-Critically Ill Patients
2. Implementation and Suspension of an Antimicrobial Stewardship Audit and Feedback Program: Impact on Antimicrobial Utilization Patterns in an Inpatient General Internal Medicine Unit
3. Voriconazole Prophylaxis in Leukemic Patients: A Retrospective Single Centre Study (award—see page 62)
4. Assessment of a Therapeutic Drug Monitoring Strategy of Once Daily Dosing of Gentamicin/Tobramycin in Paediatric Patients
5. A Drug Use Evaluation of Aerosolized Ribavirin at a Canadian Teaching Hospital

Medication Safety / Adverse Drug Events (1)

1. Hypoglycemia in Paediatric Cardiology Patients Initiated on Propranolol: A Retrospective Review
2. Anticholinergic Potential Risk Assessment Scales: Comparison of Drugs and Risk Scores
3. Photosensitivity Associated with Long-Term Voriconazole Therapy: A Case Report
4. Safety of Enteral Nutrition Interruption around Levothyroxine Doses in Critical Ill Patients
5. Étude rétrospective des accidents et incidents associés à la documentation des doses de médicaments dans un hôpital universitaire

Medication Safety / Adverse Drug Events (2)

1. Rapid Onset of Cholelithiasis in an Adult Treated with Ceftriaxone
2. Evaluation of the Use of 'Do Not Use Abbreviations' in Hospital Orders: A Quality Assurance Audit
3. Leveraging the Electronic Health Record for Medication Safety Indicators
4. Implementation of Barcode Medication Administration Using a Quality Improvement Approach
5. Factors Influencing Prescribing of Direct Oral Anticoagulants in the Elderly Leading to Adverse Outcomes: An Analysis from the Windsor Region

Clinical Pharmacy (1)

1. Medication Reconciliation at Hospital Admission: Proactive versus Retroactive Models
2. Assessing Medication Reconciliation in Hospitalized Adult Patients Discharged from Accountable Care Units in Saskatchewan Health Authority - Regina
3. The Utilization of Splenectomy Post-Op Clinical Vaccinations Order Sets to Enhance Adherence and Timeliness of Vaccinations in Splenectomy Patients: A Pre-and-Post Intervention Study
4. Utilization of Health Literacy Assessment Tools to Tailor Patient Counselling
5. Development of an Inpatient Pharmacist Diabetes Educator Role

Clinical Pharmacy (2)

1. Analyse descriptive des publications dans le domaine de la pharmacie 1973 à 2016
2. Face and Content Validation of an Instrument to Measure Medication Management Capacity in Older Adults
3. Improving Pharmacist-Pharmacist Communication at Hospital Discharge
4. Exploring the Perspectives of Healthcare Professionals in Delivering Optimal Oncology Medication Education
5. Development and Implementation of a Competency Assessment Tool for Hospital Pharmacists

Pharmacotherapeutics

1. Transition to Insulin Pens in Inpatient Rehabilitation and Mental Health Care Hospitals
2. Point Prevalence Survey of Benzodiazepine and Sedative-Hypnotic Drug Use in Long-Term Care
3. Benzodiazepine and Sedative-Hypnotic Drug Use in Hospital: Perspectives from Healthcare Providers
4. Investigation of the Average Duration of Dual Antiplatelet Therapy in Dialysis and Pre-Dialysis Patients
5. Revue de l'utilisation de l'eculizumab

Drug Stability and Sterility (1)

1. Preliminary Evaluation of the NAPRA 6-hour Rule for Single-Use Vials after First Puncture in an ISO-5 Environment
2. Physical Compatibility and Stability of Ascorbic Acid Injection in Polyvinyl Chloride Minibags at 4°C and Room Temperature (25°C)
3. Stability of 2.5mg/mL Indocyanine Green (ICG) Solutions Stored in Syringes at 25°C, 4°C, -20°C and -67°C
4. Development of an On-Going Sterility Monitoring Program for Single-Use Vials Undergoing Multiple Access Following Application of a Closed System Transfer Device

Drug Stability and Sterility (2)

1. Stability of 0.04, 0.1, and 0.2 mg/mL Vitamin K (Phytonadione) in 5% Dextrose in Water Solutions Stored in Polyvinyl Chloride Bags at 4°C over 9 Days
2. Élaboration d'outils et de politiques et procédures sur les préparations stériles
3. Stability of 9.1, 10.7 and 16.7 mg/mL Calcium Gluconate Solutions in Normal Saline and/or 5% Dextrose in Water Stored in Polyvinyl Chloride Minibags at 4°C over 9 Days

Improving Management of *Clostridium difficile* Infection by Direct Notification to Pharmacists

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Background: Infection Prevention and Control (IPAC) conducted a multidisciplinary, retrospective review of *Clostridium difficile* infection (CDI) cases to identify process improvement opportunities in the prevention and treatment of CDI. In addition to important infection control interventions, the pharmacist's scope of practice was recognized to be valuable in identifying medication-related issues in the treatment of CDI.

Description: The goal of this collaborative project between Microbiology and Antimicrobial Stewardship was to reduce rates of CDI, improve treatment of CDI by increasing adherence to guidelines, and by involving the pharmacist in each CDI case.

Methods: A novel process was developed whereby the Microbiology Lab provided direct email notification of a positive CDI result to the pharmacist team. Upon receipt, the most responsible pharmacist for that patient assessed the severity of CDI, suggested initial therapy and addressed medication-related risk factors. Each case was documented electronically and interventions were tracked. Descriptive statistics were used for analysis.

Evaluation: Over the 1 year study period, CDI rates decreased, and no CDI outbreaks had occurred. Pharmacists had intervened on >90% of cases. Of the assessments completed, an average of 25% of cases required intervention on the initial drug therapy regimen and an average of 36% of patients required risk factor modification. Time from notification to first dose of antibiotic was reduced to <2 hours from an average of 3.4 hours. The acceptance rate for interventions was >90% on initial therapy and 80% for risk factor modification.

Implications: Overall, this process has demonstrated the need and value for proactive pharmacist involvement in CDI treatment and a pharmacist review of all CDI cases has now become standard of care at this centre.

Development and Evaluation of an Infectious Diseases Education Program for Pharmacists

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Background: As part of a broader practice standardization project, an education program was developed focussing on a series of high risk, but commonly seen therapeutic topics. Infectious disease 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, an infectious diseases education module was developed, implemented and evaluated.

Action: The infectious diseases 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 21-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 is consisted of a questionnaire asking about the pharmacist's own confidence and of their colleagues to identify and resolve infectious diseases related DTPs, and the perceived value of the program.

Evaluation: Fifty-two pharmacists completed the pre- and post-module tests. Post-module completion, the average test score increased from 85% to 94%. The majority of the pharmacists (51/52 [98%]) 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 infectious disease DTPs, and perceived the program as beneficial to improve patient care and safety.

Implications: The results suggest that pharmacists benefitted from an infectious diseases 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.

Sustaining Antimicrobial Stewardship Program in an ICU over More than 5 Years: Enabling ICU Pharmacist Practice

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Background: Antimicrobial agents are one of the most prescribed medications in the intensive care unit (ICU). The goal of an antimicrobial stewardship program (ASP) is to promote appropriate antimicrobial use to optimize patient outcomes. We aimed to evaluate the impact of two ICU pharmacists in promoting stewardship practices and changing antimicrobial prescribing during daily multidisciplinary rounds in a 20-bed medical-surgical ICU.

Description: We tracked the number and type of interventions by ICU pharmacists and ASP team. Outcomes include defined daily doses (DDD), length of ICU stay and mortality.

Action: Formalized ASP audit and feedback rounds involving infectious diseases and ICU physicians and pharmacists started in 2011, initially weekly then bi-weekly. ICU pharmacists took on the responsibility for promoting and documenting ASP activities on daily multidisciplinary ICU rounds.

Evaluation: Since 2013, ICU pharmacists documented 3548 interventions and ASP team documented 296 interventions. ICU pharmacists made 92% of all interventions. The majority of interventions were accepted by the intensivists (90% of ICU pharmacist and 99% of ASP team interventions). ICU pharmacist interventions have decreased from 3 to 2.6 per day. Similarly, ASP team interventions have decreased from 1.4 to 1.27 per ASP rounds. Types of ICU pharmacist interventions include dosing (43%), spectra (15%), discontinuation (15%) and duration (15%). Prescribing of broad spectum antibiotics and antifungals has decreased since 2013: DDD (-32%), carbapenems (+35%), vancomycin (-23%), floroquinolones (-60%), piperacillin-tazobactam (-19%) and antifungals (-47%). Average mortality for patients admitted to ICU for more than 72 hours was 9%. Average length of ICU stay was 5 days. Both were similar to prior ASP implementation.

Implications: Given their daily presence, ICU pharmacists can make more ASP interventions than ASP teams who are not present daily. ICU pharmacists complement a successful and sustainable ASP as shown by the reduction in antimicrobial utilization and changes in prescribing culture.

Determination of Antibiotic Susceptibilities in *Aerococcus urinae* Urinary Isolates

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Background: *Aerococcus urinae* is a Gram-positive organism, initially identified in 1992. It is known to cause urinary tract infections (UTIs), bacteremia, and endocarditis in humans. There is limited data regarding the susceptibility of *A. urinae* to first-line antimicrobials indicated for the treatment of UTIs. In 2016, *A. urinae* was isolated in 125 urine samples processed by four hospitals in the region. The unfamiliarity with this organism and the lack of local antimicrobial susceptibility rates presents a challenge for clinicians and often results in the unnecessary use of broad-spectrum antibiotics.

Objectives: The primary objective of this study was to establish the susceptibility rate of *A. urinae* urinary isolates to cefazolin, ampicillin, nitrofurantoin, fosfomycin, and ciprofloxacin. The secondary objective was to identify demographic characteristics associated with *A. urinae* bacteriuria in our patient population.

Methods: Urinary samples received by the laboratory from October 2017 to June 2018 underwent routine identification as per physician orders. Samples that grew *A. urinae* were included in this study and subjected to susceptibility testing. Susceptibility testing was conducted via disk diffusion and results were interpreted based on published breakpoints for zone diameters. Results were analyzed using descriptive statistics.

Results: A total of 72 isolates were included. Susceptibility rates for cefazolin, ampicillin, nitrofurantoin, fosfomycin, and ciprofloxacin were 100%, 99%, 99%, 96%, and 65%, respectively. The average age of patients was 79 years, 63.9% were female, 31.9% were recently hospitalized, and 44.4% were residents of a long-term care facility.

Conclusion: Cefazolin, ampicillin, nitrofurantoin, and fosfomycin demonstrated good in vitro activity against *A. urinae*. In contrast, ciprofloxacin demonstrated decreased activity against this organism. Currently recommended first-line agents for the management of uncomplicated UTIs could be utilized to treat this organism. Characteristics of patients with *A. urinae* bacteriuria are consistent with risk factors predisposing to UTIs.

An Evaluation of Daptomycin Prescribing and Clinical Outcomes: A Retrospective, Single-Centre Experience

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Background: Daptomycin is approved for skin/soft tissue infections due to *S. aureus* and selected *Streptococcus spp*., and *S. aureus* bacteremia/endocarditis (right-sided, native valve). Prescribing has increased at our institution since 2015.

Objectives: The study objectives were to describe prescribing patterns of daptomycin, and to identify the rate and predictors of clinical failure in the overall population and vancomycin-resistant *Enterococcus* (VRE) subgroup.

Methods: This was a retrospective cohort study of adults prescribed daptomycin for >48 hours (without exposure in the preceding 3 months) between April 2015 and March 2017. Primary outcomes were patient, infection, and treatment factors associated with daptomycin prescribing. Secondary outcomes were the rate and predictors of clinical failure (a composite of in-hospital mortality, daptomycin discontinuation due to toxicity or suboptimal response, and readmission for or retreatment of the index infection). Descriptive and multivariate analyses were performed.

Results: Among 81 patients enrolled, 58.0% were male, median age was 60 years, and 42.0% had a *Charlson Comorbidity Index* of ≥5. Of 38 bacteremic patients, 18.4% had a *Pitt Bacteremia Score* of ≥4 and 52.6% were bacteremic for >4 days. The most common infections were bloodstream, intraabdominal, and bone/joint. VRE was isolated in 50.6% of patients. Prescribing was off-label in 88.9% of cases. The median dose was 6 mg/kg overall and in the VRE subgroup. The clinical failure rate was 37.0% (30/81) overall with 13 deaths, and 46.3% (19/41) in the VRE subgroup with 9 deaths. The risk of clinical failure increased with bacteremia for >4 days (OR 6.36, 95% CI 1.34-30.17, p=0.02).

Conclusions: Daptomycin was mainly prescribed off-label for VRE. The median dose of 6 mg/kg was consistent with manufacturer recommendations for *S. aureus* bacteremia. The clinical failure rate in the VRE subgroup exceeded the overall rate, suggesting antimicrobial stewardship opportunities to evaluate formulary restrictions, indications, and dosing for daptomycin.

Determining Key Quality Assurance Indicators for Advanced Pharmacy Practice Experiences Placement Site Visits

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Background: In order to perform effective experiential education placement site visits, there should be a standard set of key quality assurance (QA) indicators.

Description: The objective of our study was to generate a consensus among experiential education faculty of Canadian pharmacy schools for the most important key QA indicators for Advanced Pharmacy Practice Experiences (APPE) site visits.

Action: We surveyed members of the Pharmacy Experiential Programs of Canada using an online two-round Delphi questionnaire, with a focus on four main categories of QA indicators for APPE site visits: (1) learning-centered environment; (2) preceptor-related factors; (3) student-related factors; and 4) organization of placement site.

Evaluation: We identified the top three indicators for each category. For category 1, the top-ranked indicators were: defined roles for students; student access to drug information and patient records; and adequate physical space for student work. For category 2, the top three were: regular and consistent feedback provided to students by preceptor; preceptor availability; and preceptor's professionalism. For category 3, student involvement in pharmaceutical care processes; student providing counselling to patients; and student involvement in expanded-scope practices were the highest ranked indicators. For category 4, clear learning objectives; specific examples used in the midpoint/final evaluations; and activities planned to meet learning objectives were the most important.

Implications: Implementing an APPE site QA indicator checklist for the entry-to-practice Doctor of Pharmacy curriculum in Canadian institutions is of high priority as we develop and advance our experiential education programs for training new pharmacy professionals.

Preceptor Experiences with Novel Student-Preceptor Models in Pharmacy Education: A Qualitative Analysis

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Background: Implementation of the Entry-to-Practice Doctor of Pharmacy program in Canadian pharmacy education has required institutions to host more students for experiential rotations. In response, some institutions have explored novel student-preceptor models: peer-assisted-learning (PAL; ≥2 students of the same educational level), near-peer-teaching (NPT; ≥1 junior student(s) with ≥1 senior student(s)), and co-preceptorship (CoP; ≥2 preceptors).

Description: The objectives of this study were to describe the experiences of pharmacy preceptors in novel student-preceptor models and to assess the models using Kirkpatrick's framework for evaluating educational interventions.

Action: Pharmacists who hosted final-year pharmacy students in novel student-preceptor models in institutional settings were interviewed. Transcripts were coded and analyzed using Kirkpatrick's framework to generate themes about participants' experiences and perceptions of the models.

Evaluation: Twenty preceptors from 13 institutions were interviewed, and 13 themes were identified. Fourteen preceptors had experience with PAL, 9 with NPT, and 9 with CoP. Preceptors perceived that NPT and PAL fostered comfortable learning environments that supported students' success; challenges included increased time spent teaching multiple students and completing evaluations. CoP allowed preceptors to balance teaching with clinical duties while broadening students' exposure to different practice settings. Preceptors improved skills in time management, communicating feedback, and adapting to students' learning needs. Novel rotation models allowed preceptors to provide care to more patients and complete projects, thus extending their professional practice. They also perceived that students participating in these models developed a greater sense of responsibility for patient care, and they are primed to work collaboratively with pharmacy colleagues.

Implications: Preceptors expressed satisfaction with novel student-preceptor models. The models enhanced the learning, skill development, and professional practice of both preceptors and students. Widespread adoption of these models in pharmacy experiential education would support students' development of knowledge, skills, attitudes, and behaviours essential for their future practice.

Development of a Baseline Assessment Tool for Pharmaceutical Care Knowledge and Skills for Incoming Pharmacy Residents

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Background: Hospital residency programs utilize various tools to assess baseline knowledge and experiences of new residents. No baseline assessment tool has been systematically proven to predict the academic performance of residents or accurately reflect the impact of the residency program on resident learning.

Description: The authors developed a baseline assessment tool for incoming pharmacy residents to better assess baseline pharmaceutical care knowledge and skills.

Action: An external scan of existing tools was conducted with provincial pharmacy residency programs. A literature search for existing baseline assessments in academia was completed using key words (competencies, entry-level, baseline, evaluation, residency, needs assessment, background knowledge, student, pharmacy, medical, nursing) in scientific and educational search engines (Ovid MEDLINE, ProQuest, Web of Science, Scopus, Google Scholar). Thirty articles were retrieved, and 15 were deemed relevant through independent review by two authors. The article review was also complemented with a final discussion between all authors. Utilizing an iterative process, a baseline test was developed consisting of a pharmaceutical care-based case coupled with an assessment rubric. The rubric assesses 4 competency domains (problem recognition and work-up, organization of thinking, critical thinking and therapeutic knowledge and problem solving). Face and content validity were evaluated by expert content reviewers.

Evaluation: The tool was piloted on the incoming resident of 2018 as a 90-minute open-book test followed by a resident oral presentation and coordinator debrief guided by the rubric. Feedback from the pilot test suggested the test was too long, but otherwise provided a good framework for discussion about the resident's baseline pharmaceutical care knowledge and skills.

Implications: The tool provided useful feedback on the baseline pharmaceutical care knowledge and skills of the resident. More widespread use with systematic evaluation of the assessment tool is planned.

Virtual Patients: Bridging the Gap between the Classroom and Clinical Pharmacy Practice

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Background: When students encounter real patients during their experiential rotations they are overwhelmed with the quantity of information available limiting their ability to care for patients. Virtual patients (VPs) provide a bridge from classroom knowledge acquisition to real-life knowledge application. VPs give students the opportunity to engage in simulated clinical scenarios which includes navigation of a construct of medical records and patient interviews, in order to assess a patient's medication therapy. While benefits exist, the development and implementation of VPs is a time intensive process.

Objective: To evaluate the incorporation of VPs into an Entry to Practice Doctor of Pharmacy Program.

Methods: A 16-question survey was disseminated to all Year 1, 2 and 3 students. In addition, as Year 2 students were the first students to encounter the VPs, they were also invited to participate in a focus group. Descriptive statistics were used to analyze the survey data. The focus group was audio recorded, transcribed and thematically analyzed.

Results: A total of 180 students participated in the survey for a response rate of approximately 28%. From all three classes, 170/180 (94.4%) of respondents strongly agreed/agreed that the incorporation of VPs was valuable for their learning. Students felt the VP cases helped them to learn more about the main medical conditions in the case (YR1 = 72%; YR2 = 87%; YR3 = 90%) and develop their clinical reasoning skills (YR1=78%; YR2=97%; YR3=95%). Participants in focus groups described the following benefits to their learning: a) becoming active decision makers through engaging in a process-based experience; b) being exposed to, and gaining knowledge about, 'real world' cases and documents (e.g., nurses notes); and c) applying and solidifying classroom-based learning.

Conclusion: Students find VPs to be valuable to their learning and development of clinical reasoning skills.

Atlantic Canadian Hospital Pharmacists in Direct Patient Care: Experiences as Preceptors

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Background: Expanded experiential learning is a major component of the Doctor of Pharmacy degree program being developed at Dalhousie University. Hospital practice sites and preceptors will be vital to clinical learning. A large survey of hospital pharmacy preceptors in the region affiliated with Dalhousie University was conducted to understand the experiences, learning needs, barriers, motivators, and interest in various preceptor models.

Description: The part of the project presented here describes precepting experiences of pharmacists in direct patient care.

Action: A literature search was conducted to identify examples of preceptor surveys. Items for the questionnaire came from the literature and the project's Advisory Board members. The draft was piloted, and changes made. In May 2017, the regional hospital pharmacy management group, the local branches of the Canadian Society of Hospital Pharmacists, Faculty at Dalhousie University, and representatives from hospitals in the region were emailed an invitation to participate in the on-line survey. Statistical analysis was completed using Minitab Statistical Software Version 14.

Evaluation: Approximately 57% of respondents indicated that they were pharmacists in direct patient care and of this group 53% had worked 10 years or less with 40% being from New Brunswick and 37% from Nova Scotia. Ninety-seven percent of the pharmacists in direct patient care had served as a preceptor, with 53% indicating that they had done so for 7 or more years. Fifty-three percent of pharmacists in direct patient care had precepted 1 or 2 undergraduate pharmacy students in the previous 12 months, with 83% reporting spending greater than 7 hours per week in precepting related activities. The two most common reasons for not serving as a preceptor were "competing priorities" and "insufficient time".

Implications: This information helps inform the development of resources and strategies to sustain pharmacy clinical learning within Atlantic Canadian hospitals.

Real-Time Tracking of Nursing Requests for Missing Medications

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Background: Despite advances in medication systems technology, "missing medications" remain a considerable source of frustration, wasted time, effort and money in the medication distribution and administration process. Nurses report medications as "missing" when a medication isn't readily available at the expected time and location.

Description: We conducted a real-time evaluation of missing medication requests to better understand causes and contributing factors. In a previous study, 1 medicine unit (Unit A, 66 beds) and 1 surgical unit (Unit B, 36 beds) were identified as the highest reporters of missing medications at our 455-bed, 24-hour unit dose, cart-fill, urban academic teaching hospital.

Action: This ethics-approved, quality-improvement project assessed "missing dose requests received by the inpatient pharmacy, over 8 prespecified 8-hour periods for the above 2 inpatient units. Study investigators described and tracked the history and pathway of each "missing" medication to determine why it hadn't initially been locatable by the nurse.

Evaluation: A total of 102 missing medication requests were received: 61 and 41 on units A and B, respectively. The distribution of new versus existing medication orders was 66.7% and 33.3%, respectively. Twenty-four missing medication requests (23.5%) were attributable to delivery delays (e.g. medication processed, filled and waiting to be delivered to the floor). Medications for 23 requests (22.5%) were easily and immediately found by the study investigators in what would have been the "correct" or "predictable" location according to usual medication delivery processes. Unit transfer issues accounted for 21 requests (20.5%). There were 12 requests (11.8%) for "legitimate" re-issues (e.g. medication fell on floor, bulk items empty). Pharmacy had not dispensed the medication in 12 of the cases (11.8%) due to error or system-related oversights. Medications for only 5 requests were untraceable (4.9%).

Implications: Future initiatives aimed at reducing missing medications will focus on the main contributing factors identified.

Kratom-Induced Acute Liver Failure

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Background: The majority of Canadians have used natural health products (NHP) with 12% reporting an adverse reaction. Substances not approved by Health Canada may be associated with health risks. A case of acute liver injury following exposure to kratom, an unlicensed NHP, is described.

Case Description: A previously healthy young adult presented to the Emergency Department with vomiting, epigastric pain, and transaminitis following recent consumption of kratom, alcohol, and acetaminophen. The ALT, AST, and total bilirubin continued to rise after admission reaching more than 2,700 U/L, 2,900 U/L, and 190 mol/L, respectively. Blood cultures grew Salmonella javiana. The patient was transferred to the Intensive Care Unit with fulminant liver failure and successfully underwent transplantation.

Assessment of Causality: The patient had a two-day history of heavy alcohol consumption prior to admission. A daily dose of 4 grams of acetaminophen was taken for 3 days following the alcohol binge. Prior to that, 3-4 tablespoons of kratom powder were consumed to boost energy. Urine toxicology and viral hepatitis screens were negative. Wilson disease was ruled out. Given the limited exposures, acetaminophen and alcohol were deemed unlikely to be the cause of the liver failure. Kratom was considered to be a probable provoking agent, as determined by a Naranjo score of 6.

Literature Review: There have been case reports of cholestatic hepatitis attributed to kratom use in the United States. However, there have been no reports in Canada. Previous cases have reported reversible liver injury following discontinuation of the product. To our knowledge, this is the first report of liver failure necessitating transplantation following recreational use of kratom.

Importance to Practitioners: Health risks associated with unapproved NHPs are not clearly defined. The emergence of toxicity reports with kratom is concerning for patient safety. Practitioners should advise against the use of potentially dangerous products.

Autoimmune Hepatitis after Receiving One Cycle of Nivolumab/Ipilimumab

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Background: Checkpoint inhibitors have been found to cause several autoimmune reactions with varying frequency. Autoimmune hepatitis is a less frequently occurring immune mediated event and often initially presents with nonspecific signs and symptoms. Additionally, the time to onset of immune-mediated adverse effects varies greatly; from days to months.

Case Description: A 59 year old male was diagnosed with metastatic melanoma and was started on palliative ipilimumab and nivolumab. Fifteen days after receiving the first cycle the patient reported numerous symptoms including fatigue, decreased appetite, shortness of breath and intermittent fevers. He was admitted with a presumed diagnosis of sepsis and mildly elevated liver function tests (LFTs), which had been normal at baseline. All cultures returned negative and a rapid rise in LFTs occurred. The symptoms and LFTs resolved after discontinuation of nivolumab/ipilimumab and initiation of dexamethasone.

Assessment of Causality: A Naranjo scale score of 7 indicates that the immunotherapy is the probable cause of hepatitis. The time to onset of symptoms and the LFT increase is consistent with these medications. Additionally, the pattern of LFT elevation is consistent with autoimmune hepatitis and there were no acute ingestions of other substances as alternative causes. Resolution occurred with discontinuation and dexamethasone treatment, which is also consistent with checkpoint inhibitor-induced hepatitis.

Literature Review: Multiple cases of hepatitis with ipilimumab have been reported. However, only 3 publications for each nivolumab and nivolumab/ipilimumab were found upon literature review. To our knowledge, this is the first report for either agent where the reaction occurred after the first cycle.

Importance to Practitioners: Due to increased use, there is a growing importance for practitioners to be aware of checkpoint inhibitor-induced autoimmune reactions and their often nonspecific presentations. In particular, knowledge of the significant variation in onset is important in prompt diagnosis and prevention of lasting complications.

Characterization of Medication-Related Near Miss Safety Events

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Background: Hospitals require medication-related Safety Events to be reported to prevent harm to both patients and staff. The 2004 Canadian Adverse Events study by Baker et al identified that 1/3 of hospital adverse events were preventable. Adverse events related to medications and fluid were the second most common type. Safety Events can be classified as Near Miss Safety Events, Precursor Safety Events, and Serious Safety Events. Near Misses have not reached the patient and have not caused harm. They are often identified through a detection barrier in place to prevent the error. By analyzing these events we can learn how to prevent more serious events in the future.

Description: To characterize Medication-Related Near Miss Safety Events (MRNMSE) reported at a 433 bed teaching hospital between 1 Jan 2017 to 31 Dec 2017.

Action: A retrospective review of MRNMSE was conducted for the specified time period. Specifically, MRNMSE were characterized as pharmacy-related and if pharmacy-related then subcategorized as repackaging errors, dispensing/supply errors, workflow errors, or other pharmacy-related errors.

Evaluation: In total, 175 MRNMSE were reviewed. Of these 41.1% (72/175) were pharmacy-related and are characterized in the Table. Of pharmacy-related MRNMSE 22.9% (40/175) were dispensing/supply errors. Common contributors identified were wrong drug/same strength, right drug/wrong strength, and right drug/wrong route.

Implications: Although 72 MRNMSE were characterized as pharmacy-related, the overall incidence was low since more than 3 million oral doses were dispensed during the same time period. Repackaging Errors and Dispensing/Supply Errors were both reported by nurses when using automated dispensing cabinets so developing detection barriers to prevent Safety Events related to loading/refilling automated dispensing cabinets could be beneficial.

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

Incidents Associated with Centralized Automated Processing of Multi-Medication Compliance Packs

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Background: Studies have found that manual preparation of multi-medication compliance packs is associated with significant risk of medication incidents. Centralized automated prescription processing is a future trend in pharmacy.

Description: The purpose of this study was to characterize and analyze medication incidents associated with automated preparation of compliance packs at the largest centralized prescription filling facility in Canada.

Action: We performed descriptive statistics and qualitative thematic analysis on incidents associated with 10 automated compliance pack preparation machines (i.e. robots) reported by pharmacy professionals at the centralized filling pharmacy from December 2017 to January 2018.

Evaluation: A total of 121,250 compliance packs were prepared during the study period, of which 4.82% was associated with an incident. The most common types of incidents were "pill jump" (18.89%), "additional pill" (18.29%), and "missing pill" (15.52%). Incidents were categorized into three main themes: manual processes; equipment maintenance; and implementation of standard operating procedures. Recommendations included automation of human-involved processes, review of current policies and procedures, education/training of staff, and fine-tuning of machine/robot performance.

Implications: We found a 33% reduction in incident rates with centralized automated processing of compliance packs when compared to what was reported for manual preparation in the literature. Areas of improvement in a centralized automated prescription filling pharmacy should focus on reducing human errors, improving robot function, and enforcing staff compliance with standard operating procedures.

Chemical Stability of Cloxacillin in Sterile Water for Injection (SWFI) Stored in Polypropylene (PP) Syringes (50 and 100 mg/mL) and Glass Vials (250 mg/mL) at 4°C and 25°C

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Background: Interruptions in minibag supplies necessitated conservation strategies, including compounding cloxacillin in syringes and administration by direct IV.

Objective: To evaluate the chemical stability of cloxacillin reconstituted with Sterile Water for Injection (SWFI) at concentrations of 250 mg/mL in glass vials and 50 and 100mg/mL in PP syringes at 4°C and 25°C.

Methods: On study day 0, 10g vials of cloxacillin were reconstituted with 40 mL of SWFI (250mg/mL). Vials were further diluted with SWFI to achieve concentrations of 50 and 100mg/mL and drawn into PP syringes. Vials and syringes were stored at 4°C and 25°C. Cloxacillin concentration analysis was completed on study days 0,1,2, 4, 7,10,14,17 and 21 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 cloxacillin and measured the concentration specifically, accurately and reproducibly (0.56% [CV(%)]). During the study period all solutions retained more than 90% of the initial concentration for the entire study period (14 days) at 4°C and for 24 hours at 25°C. Multiple linear regression revealed significant differences in percent remaining due to study day ($p<0.001$) and temperature ($p<0.001$) but not concentration ($p=0.679$) or container ($p=0.803$). The calculated T-90, with 95% confidence exceeded 14 days for all concentrations at 4°C and 1 day at 25°C.

Conclusions: This study demonstrated that cloxacillin solutions in vials (250mg/mL) and syringes (50 and 100mg/mL) can be stored for up to 14 days if continuously stored at 4°C and 1 day at 25°C. If the syringes are exposed to room temperature, the maximum storage is 7-days at 4°C, allowing 12 hours exposure at 25°C during this 7-day period.

Stability of 1.0, 0.2 and 0.025 mg/mL Milrinone Solutions Stored in Syringes at 4°C and at Room Temperature (25°C)

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Background: Inpatient hospital pharmacies must compound intravenous products and assign an appropriate beyond-use-date (BUD) as per NAPRA standards. While previous publications have demonstrated the stability of milrinone, data for lower pediatric concentrations stored in syringes for more than 14 days is not available.

Objective: To evaluate the chemical stability milrinone prepared in syringes at concentrations of 1 mg/mL (undiluted), 0.2 and 0.025mg/mL (diluted in either 0.45% sodium chloride or 5% dextrose in water (D5W)) at both room temperature and in the refrigerator.

Methods: On study day 0, 60mL solutions of 1, 0.2 and 0.025mg/mL concentrations of milrinone were prepared in 60mL BD syringes. 3 units of each container and concentration were stored at room temperature (25C) and 3 were stored at 4C. Concentration analysis was completed on study days 0,1,7,14,21,28,42,54,75 and 90 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 milrinone such that the concentration was measured specifically, accurately (deviations from known averaged 2.24%) and reproducibly (replicate error averaged 0.66%(CV(%)). During the study period all solutions retained more than 98.14% of the initial concentration. Multiple linear regression revealed significant differences in percent remaining due to study day ($p=0.008$) and temperature ($p = 0.0276$) but not concentration ($p= 0.108$) or diluent ($p= 0.635$). The calculated T-90, with 95% confidence, exceeded 155.61 days for all concentrations, temperatures and diluents.

Conclusions: We conclude of 1 mg/mL (undiluted), 0.2 and 0.025mg/mL diluted in either 0.45% sodium chloride or D5W, stored at either room temperature or in the refrigerator in polypropylene BD syringes are physically and chemically stable for 90 days.

Stability of Magnesium Sulphate Solutions in PVC Minibags, Non-PVC Minibags, and Polypropylene Syringes Stored at 4°C

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Background: To our knowledge, no stability data exist for magnesium sulphate solutions in plastic bags and syringes.

Objectives: To test the physical and chemical stability of 10 and 143 mg/mL magnesium sulphate solutions stored at 4°C for 14 days in polyvinyl chloride (PVC) minibags, non-PVC minibags and polypropylene syringes.

Methods: The bags and syringes containing the magnesium sulphate solutions were stored at 4°C for 14 days. Samples were taken daily and frozen at -20°C, pending analysis. Samples from selected days through the study were analysed in quintuplicate on a Roche Cobas C 701 analyzer. Magnesium concentration means from each selected day were compared to those of Day 0 by calculating them as a percentage of the Day 0 value. Chemical stability was demonstrated if lower limit of 95% confidence interval did not fall below 90% of the Day 0 value. Physical stability was assessed by daily colour and clarity checks.

Results: One magnesium sulphate solution, 10 mg/mL magnesium sulphate in 0.9% sodium chloride in the PVC minibag, performed similarly to all of the other solutions up to Day 13, but on Day 14 the % of Day 0 value fell to 75%. The lower limits of the 95% confidence intervals of all of the other solutions remained above 90% of the Day 0 concentration for the entire 14 day study. All of the magnesium sulphate solutions remained clear and colourless throughout the study.

Conclusions: All magnesium sulphate solutions were physically stable for 14 days. All magnesium sulphate solutions except the 10 mg mL solution in 0.9% sodium chloride in the PVC minibag, were chemically stable stored at 4°C for 14 days, but all solutions were chemically stable for 9 days.

Stability of Cardioplegia Additive Solution in Polyvinyl Chloride Bags Stored at 4°C for 9 Days

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Background: To our knowledge, no stability data exist for the cardioplegia additive solution (adenosine 0.12 mg/mL, dextrose [glucose] 150 mg/mL, lidocaine 2 mg/mL, magnesium sulphate 200 mg/mL).

Objectives: To test the physical and chemical stability of the cardioplegia additive components, (except insulin) when stored at 4°C in polyvinyl chloride (PVC) minibags for 9 days.

Methods: The cardioplegia additive solution was stored in minibags at 4°C for 9 days, with samples taken daily and frozen at -84 °C, pending analysis. Samples from selected days through the study were analysed in quintuplicate. Glucose and magnesium concentrations were measured on a Roche Cobas C 701 analyzer. Adenosine and lidocaine were measured by gas chromatography/mass spectrometry, with each drug having its own internal standard (ISTD). From each measurement, drug/ISTD peak area ratios (PARs) were calculated for adenosine and lidocaine. Component concentrations from each selected day were compared to those of Day 0 by calculating them as a percentage of the Day 0 value. Chemical stability was demonstrated if lower limit of 95% confidence interval did not fall below 90% of the Day 0 value. Mass spectra of Day 9 drug peaks were compared to those of Day 0 peaks, to confirm purity of the measured drug peaks. Physical stability was assessed by daily colour and clarity checks.

Results: None of the lower limits of 95% confidence intervals of any components fell below 90% of the Day 0 value. Day 9 mass spectra of lidocaine and adenosine were identical to those of Day 0. The cardioplegia solution remained clear and colourless throughout the study.

Conclusions: All measured cardioplegia components were physically and chemically stable for 9 days. This compound will be assigned a beyond-use date of 9 days.

Review of Microbial Contamination of Vials Used for Compounding with Closed System Drug Transfer Devices

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Background: Vials that are punctured under ISO5 conditions must have a beyond-use date of 6 hours, per the United States Pharmacopeia chapter <797> to ensure their sterility. Some institutions are using closed system drug transfer devices (CSTD) when compounding sterile antineoplastic drugs. CSTDs offer a closed environment, so authors are arguing that the sterility is maintained and thus extend the beyond-use date.

Objective(s): To perform a literature review on microbial contamination of vials used for compounding antineoplastic drugs with CSTDs.

Methods: A literature review was performed on 2018/08/08. The following terms were searched on PubMed, Embase, CINALH: CSTD and beyond-use date. The proceedings of three relevant conferences were searched (Groupe d'évaluation et de recherche sur la protection en atmosphère contrôlée from 2013-2017, Professional Practice Conference 2013-2018 and Canadian Association of Pharmacy in Oncology 2016-2018). We included any study that presented results on microbial contamination following sterile compounding with CSTDs.

Results: A total of 397 studies were found and 13 met our inclusion criteria. A total of 1392 vials were tested, 1320 vials using a CSTD (n=11 studies) and 72 vials without using a CSTD (n=3 studies). The microbial contamination was mainly evaluated at varying time after initial puncture of the vial, 24 hours (n=8 studies), 48 hours (n=6 studies), 72 hours (n=6 studies), 7 days (n=7 studies), 14 days (n=3 studies). Five studies showed no microbial contamination. No study showed a significant difference in the percentage of contamination with and without using a CSTD.

Conclusion(s): The majority of antineoplastic drugs vials used for compounding under sterile conditions showed little or no microbial contamination. Future studies should compare microbial contamination with and without a CSTD, to validate the potential added benefit of CSTDs on maintaining sterility, when compounding is performed with an aseptic method.

Estimating the Proportion of Emergency Department Visits That Can Be Managed by Pharmacists' Expanding Scope in Ontario between 2010 and 2017

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Background: Pharmacists' scope of practice has expanded significantly in Canada, which may help alleviate emergency department (ED) workload for minor conditions and prescription renewals. Previous research revealed that a considerable percentage of ED visits are not urgent and can be managed by primary health care activities. However, it is not known how many of these cases can be managed by pharmacists within expanded scope of practice.

Objectives: The aims of this study are to: (1) Determine the proportion of ED visits that can potentially be managed by pharmacists within their expanded scope of practice, and (2) Determine the most prevalent conditions within these cases that can be managed by pharmacists.

Methods: This is a retrospective quantitative longitudinal cohort study using administrative record-level databases provided by the Canadian Institute of Health Information (CIHI) from 2010 to 2017. Among all unscheduled ED visits in Ontario, we identified all visits with a Family Practice Sensitive Condition (FPSC) and Canadian Triage and Acuity Scale (CTAS) score of 4 ("Less Urgent") or 5 ("Non-Urgent"). We then identified a list of conditions that can be managed by pharmacists using the broadest scope available in Canada.

Results: Among the 34,550,020 ED visits identified, 12.4% (n= 4,293,807) were considered FPSC with CTAS 4 or 5. Of these, 1,494,887 (34.8%) were for conditions considered to be manageable by pharmacists, representing 4.3% of all ED visits. The most frequent diagnoses that can be managed by pharmacists were: acute pharyngitis, conjunctivitis, rash and other nonspecific skin eruption, otitis externa, cough, acute sinusitis, and dermatitis.

Conclusions: Under an expanded scope, pharmacists can manage a significant proportion of unnecessary ED visits. The introduction of ED-based pharmacists practicing under an expanded scope, or greater expansion of scope for community pharmacists, may have a positive impact on overcrowding in Canadian emergency departments.

The Impact of Pharmacist Medication Management on 30-Day Hospital Re-Admission Rates as a Member of a Rapid Response Transitional Team

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Background: Unplanned hospital admissions are associated with increased patient mortality and health care costs. In Canada, 1 in 11 patients are readmitted within a month of leaving hospital. Several factors are associated with hospital re-admissions and deemed preventable. Including pharmacists to conduct medication reviews at discharge and follow-up with the primary care physician and pharmacy can lead to reduced hospital admissions. Nurse-led Rapid Response Transitional Teams (RRTT) have been created to ensure patients thrive out of hospital, prevent hospital re-admissions, however very few of these teams include a pharmacist.

Description: A RRTT incorporated a team of 8 pharmacists to conduct in-person medication management (MM) for medically complex patients in their homes. Patients referred to the RRTT were recently discharged from hospital or referred by their family practitioner and deemed medically complex.

Action: The RRTT nurse identified patients to be referred to a pharmacist for in-home MM. The pharmacist provided MM: medication reconciliation, identification of medication discrepancies and drug-related problems, patient counselling/coaching/education and medication disposal, provision of health literacy and follow up with the patient's primary care physician and pharmacy. The pharmacist utilized the electronic health record (EMR), and community pharmacy medication histories and other resources/tools as required. The encounter and recommendations were documented in the RRTT EMR.

Evaluation: Patients who were seen by the pharmacist had a lower 30-day readmission rate (17%) compared to patients who did not (21%). The majority of patients (94%) were seen within 30 days of the RRTT referral.

Implications: Integrating pharmacists on a RRTT to conduct in-home MM can lead to a decrease in 30-day hospital readmissions.

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

Do Knowledge Gaps about Opioids Exist for Pharmacists? A Closer Look at a Novel Online Learning Platform

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Background: An online learning platform was developed to help pharmacists and pharmacy technicians build skills in various areas. In May 2018 in the context of an ongoing national opioid crisis, we developed a module to help pharmacists improve their ability to assess and manage opioid prescriptions. Funding was provided by a provincial college of pharmacists.

Objective: To evaluate pharmacists' level of knowledge and skill in assessing and managing opioid prescriptions, using data collected from a novel online learning platform.

Methods: We developed an online, quiz-based, multimedia learning platform. Pharmacy practice and therapeutics topics are presented as separate modules. The opioid module, based on national guidelines, includes five learning objectives, seven quizzes, two animated videos, two infographics, and reminder flashcards. It also links to evidence-based resources from the Canadian Pharmacists Association and the Centre for Effective Practice. De-identified quiz responses were downloaded from the platform, following an ethics approval. Each quiz question was coded to its respective learning objective to generate a mean score. Descriptive statistics were used to summarize the data.

Results: A total of 645 users completed one quiz in the module, and 200 completed the entire module. Most users were female (68%), licensed pharmacists (71%), trained in Canada (67%), practising in Ontario (90%) and had been practising an average of 13 years. Out of 5 learning objectives, users performed best on understanding how and when to start, switch, taper, and stop opioid therapy (mean score 64%). Users performed worst on identifying signs and symptoms of opioid adverse effects (mean score 55%) and making recommendations for management (mean score 55%).

Conclusion: Future education initiatives should focus on helping pharmacists improve in all areas of opioid prescribing and management, with a heavier focus needed on assessment and management of adverse effects and making recommendations for changes in therapy.

Pharmacist Medication Reviews via Videoconference: A Prospective Cohort Study Pilot Study in Remote and Rural Underserviced Communities

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Background: Canada has a publicly funded universal healthcare system, but not all residents have the same access to care, including that of a pharmacist. While urban areas have nearby pharmacies, many small communities have medications shipped to a local nursing station/hospital. Pharmacist medication reviews (PMR) in the primary care setting improve health outcomes. For patients in isolated regions, without a local pharmacist, PMR is non-existent. Multidisciplinary telemedicine teams including pharmacists have demonstrated improved health-related outcomes. Despite rapid growth of videoconferencing (VC) in remote communities for improved access to healthcare, telepharmacists continue to be underutilized.

Description: This prospective observational cohort pilot study included interviewing patients from two remote communities eligible for a PMR (at least 3 medications for chronic conditions or diagnosed with diabetes) at their hospital/nursing station via VC.

Action: The telepharmacist reviewed patient electronic sources of medication lists/medical history and identified drug-therapy problems (DTP). A motivational interviewing approach was taken -collaborative, evocative, and the honoring of patient autonomy by listening, asking, and informing. Identified DTP's were discussed with the patient and/or their prescribers. Following the interview, patients completed a PMR satisfaction questionnaire. DTP's were documented using the PCNE V6 classification system.

Evaluation: One half of all patients were eligible for PMR. Of those that were contacted, 85% agreed to participate and 40% attended the PMR. Mean times required to prepare, interview, and follow up were 13, 21, and 12 minutes respectively with 1.3 DTP identified and 10.5 medications per patient. Patients reported a 71% positive response rate in support of PMR by VC. Inefficiencies, barriers and facilitators were described.

Implications: Utilizing established VC technology to conduct PMR is acceptable by patients and offers an opportunity to address a significant disparity in the provision of health care in remote communities without in-person access to a pharmacist.

Implementation of Electronic Special Access Program Forms to Improve Workflow for Pharmacists

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Background: Health Canada's Special Access Program (SAP) allows practitioners to request access to drugs that are not available for use in Canada. While SAP request forms must be completed by the practitioner, pharmacists often facilitate and assist with SAP form completion, requiring significant time, impacting pharmacist workload. Pharmacists also report that paper forms are obsolete and electronic forms would expedite the process for both practitioner and pharmacist.

Description: As part of meeting the standards for hospital accreditation and improving workflow for pharmacists, a standardized process was needed for SAP drugs. A policy was implemented in June 2016 for patient-specific SAP requests and prescription process for inpatients.

Action: Common SAP drugs were identified and pre-built electronic forms were created. SAP workflow was developed for practitioners and pharmacists to ensure efficiency in the completion of SAP drug requests. This workflow was also integrated with the computerized physician order entry (CPOE) system to guide practitioners when ordering of SAP drugs is required. A survey, including a Likert Scale, was used to evaluate the usage of pre-built electronic SAP forms and the pharmacists' perception of the policy on their practice.

Evaluation: Fifteen pharmacists that commonly complete SAP request forms responded to the survey. The average percentage of prescribers that independently completed SAP forms increased from 25% to 58%. The average total time pharmacists spent on completing SAP requests within a month decreased from 115 min to 87 min. Survey responses indicated that a majority of pharmacists thought that the SAP completion process became overall easier to complete.

Implications: The results suggest that pharmacists working within inpatient units have benefitted from pre-built electronic SAP forms, reducing time spent on SAP requests and making the overall process easier. In the future, forms for other SAP drugs should be implemented.

Use of Extensive Auditing to Reduce Potential Diversion of Narcotics and Controlled Drugs in a Healthcare Facility

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Background: Fueled by the opioid epidemic, narcotic and controlled drug (NCD) diversion is unfortunately a common occurrence in Canadian healthcare facilities. Media investigations have outlined the extent of this diversion. More and more, healthcare facilities are being held accountable to ensure the medication distribution process for NCDs is rigorous in preventing diversion.

Description: Following the implementation of a new electronic medical record (EMR) and computerized physician order entry (CPOE) system with electronic medication administration records (eMAR), our facility began conducting numerous audits around the distribution of NCDs.

Action: Several processes were implemented to monitor for diversion: daily reconciliation for any NCDs dispensed by override; monthly graph reports for specific injectable NCDs; random oral NCD usage reports; and checks against charts of discharged patients, which are still accessible for 24 hours after discharge. In addition to random user audits, should usage for any user be outside of range, user-specific audits are performed. Routine user audits reconcile dispenses taken against the medication order. The selection for these is chosen at random and includes both high and low volume users. Pharmacy transactions are also subjected to auditing. NCDs stocked in the automated dispensing units (ADU) are compared with the quantities removed from the department. NCDs retrieved from ADU return drawers are reconciled with quantities re-stocked or returned to pharmacy.

Evaluation: Over a one year span, medication incidents involving NCD discrepancies decreased by 98%, from 50 in July 2017 to 1 in June 2018. Audits and monitoring are ongoing.

Implications: Establishing an intensive auditing process improves the detection of and reduces the opportunity for diversion in a healthcare facility. The adoption of a new EMR with eMAR allowed our site to easily obtain the information required to implement this process. We believe that these results could be replicated at other healthcare facilities.

An Analysis of Medication Returns to Inpatient Pharmacy Using a Closed-Loop Health Information System

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Background: Processing medication returns is a challenging task for many acute care pharmacies. Medication returns greatly increase the workload for pharmacists and technicians, and significantly impact inventory. However, few studies have analyzed the impact of medication returns on hospital pharmacies.

Description: In December 2017, a tertiary care hospital implemented a new health information system (HIS), with closed-loop medication administration and electronic inventory tracking, incorporating perpetual inventory. Pharmacy staff were required to electronically process returns into the HIS, prior to returning unit-dosed medications to stock. This project was conducted to analyze the number of medications returned, assess the workload impact of the new process, and determine the common reasons for returns.

Action: The project consisted of two parts. Firstly, a retrospective analysis of medication returns was conducted using HIS reports to determine the number of returns, identify the commonly-returned medications, and measure the time spent by pharmacy staff processing returns. Secondly, a cross-sectional analysis was conducted to characterize the reasons medications were returned from select high-volume inpatient units. Data was analyzed using Microsoft Excel.

Evaluation: Out of 117,834 dispensed unit-doses, 30,299 units (26%) were returned to the pharmacy over a 22-day period. On average per day, 1,364 unit-doses were returned, and an estimated 4 hours was spent processing returns. Commonly-returned medications included: senna (5.8%), dalteparin (3%), polyethylene glycol (2.3%), cholecalciferol (1.9%), pantoprazole (1.9%), vancomycin (1.8%), furosemide injectable (1.8%) and tablets (1.7%). Reasons for returns included: discontinuation of therapy (19%), patient/family refused (13%), patient discharged from unit (7%), nurse professional opinion (7%), or unable to determine (8%).

Implications: Medication returns add a significant workload to hospital pharmacies. Closed-loop HIS provide tools for pharmacy administrators to understand the reasons for returned medications, identify workflow efficiencies, and improve the medication use process.

Utilization of the Electronic Health Record to Minimize Pharmacy Alert Fatigue

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Background: In 2017 and 2018, two institutions collaborated on the implementation of one single electronic health record. Pharmacists were reporting high numbers of clinically irrelevant alerts firing during order validation.

Description: The electronic health record allows for analysis of the types of alerts fired and Pharmacist response during order validation.

Action: The alerts were reviewed looking at the frequency of firing and clinical relevance. The Medication Safety Committee reviewed this analysis and made decisions to filter out the clinically irrelevant alerts identified. This practice was completed in collaboration with both institutions.

Evaluation: Drug-drug interactions accounted for 44.1% of all medication warnings. Duplicate therapy class alerts represented 17.7% of all medication warnings fired.

Implications:
The following alerts were suppressed:
Opioids (Immediate Release) / Benzodiazepines
Aminoglycosides / Penicillins
NSAIDs/Corticosteroids
Antihistamine
Parenteral solutions containing sodium

For the tables that go with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

An Assessment of the Cost-Effectiveness of 24/7 Hospital Pharmacy

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Background: Regulatory bodies such as the Ontario College of Pharmacists and Accreditation Canada have published standards that require the pharmacist to review all prescriptions prior to administration of the first dose. While this is the norm in the community, it is not always the case in hospital practice.

Objective: This study is aimed to determine the cost-effectiveness of 24/7 hospital pharmacy.

Methods: All orders were collected in a defined time-period and the time when orders were written was recorded to produce a 24-hour order distribution curve. Sub-analysis included classification of orders based on weekdays, weekend, urgency, and location. The average number of orders per hour a pharmacist can process was determined to establish a benchmark workload indicator. Based on an average pharmacists' salary including benefits, the cost per order verification was determined. This cost and workload analysis informed the 24-hour pharmacy decision.

Results: A total of 17,385 orders were included in the analysis, of which 2921 were overnight orders. Overnight workload mostly came from wards (37.9%), emergency (34.4%) and ICU areas (11.1%). For weekdays, 70% of the urgent overnight orders were written between 8PM-12AM, while 50% were written between 4PM-8PM on a weekend. The cost per order verification for weekdays and weekend averaged $0.73 and $0.76, respectively, indicating that the average order-entry pharmacist workload is 70 and 67 orders per hour on weekdays and weekend, respectively. Between 12AM-7AM the number of orders would only justify 0.36 FTE, while between 8PM-12AM, workload supports 0.72 FTE. Similar observations were made on the weekend. The number of orders between 8PM-7:30AM does not exceed the workload of 1 FTE pharmacist at each hour for weekdays or weekends.

Conclusion: The data failed to support 24/7 pharmacy operation as there was insufficient workload to justify a pharmacist's wage. However, the data did support extending pharmacy hours.

Identification and Selection of Preferred Candidates for the Position of Chief Executive Officer of a Professional Association

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Background: A chief administrator of a professional association is responsible for the leadership and management of the association in accordance with the strategic direction. Succession of such a position is of critical importance.

Description: The current chief administrator of the Canadian Society of Hospital Pharmacists (CSHP) was approaching retirement, and a successor was needed. The CSHP board of directors commissioned a Search and Selection Task Force (SSTF) to undertake the identification and selection of preferred candidates.

Action: After review and adaptation of association management best practices for recruitment of a chief administrator, the SSTF: reviewed and revised the job description; developed and advertised the job posting; performed initial screen of applications and CVs to ensure job requirements met; developed and implemented an independent ranking tool for those meeting qualifications; developed an interview guide and performed initial interviews of top candidates; developed and implemented an independent ranking tool for the first round of interviews; developed and implemented reference check guide with identified referees; ranked top candidates; developed an interview guide and coordinated top ranking candidates for a second interview conducted by the board.

Evaluation: Following the job description review, the position title was changed from executive director to chief executive officer (CEO). The job posting was advertised on three websites, with the intent of reaching an appropriate target audience. Thirty-two applications were received. Following initial review, 20 met qualifications and were ranked. The top five candidates were selected for the first round of interviews. Twelve reference checks were performed. Two candidates were selected for the second round interview with the board.

Implications: The recruitment and selection process led to an abundance of qualified candidates applying, a surplus of successful candidates at each step of the screening process, and the SSTF was successful in its mission to identify and select preferred candidates for the position of CEO.

Comparison of Preventive Cardiovascular Pharmacotherapy in Surgical versus Percutaneous Coronary Revascularization

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Background: Data suggest patients who undergo coronary artery bypass graft surgery (CABG) have a lower rate of preventive cardiovascular pharmacotherapy use compared to percutaneous coronary intervention (PCI). However, these studies do not account for justified non-use (e.g., allergy/intolerance/contraindication).

Objective: To assess rate of utilization of preventive cardiovascular pharmacotherapy at discharge in CABG versus PCI patients post-acute coronary syndrome (ACS).

Methods: Prospective cohort study was conducted at St. Paul's Hospital in Vancouver, British Columbia. Consecutive patients aged ≥18 years discharged post-ACS after CABG or PCI between January-June 2018 were included. Data collected included demographics, revascularization strategy, and preventive cardiovascular medication use specifically acetylsalicylic acid (ASA), P2Y12 inhibitors, beta-blockers, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers (ACEI/ARBs) and statins including adjustment for justified non-use. Statistical analyses included t-test and chi-square test for continuous and categorical variables, respectively, with a significance level of <0.05.

Results: One hundred and sixty patients were included. Mean age was 65 years and 83% were male. Comorbidities were similar between groups. Sixty-six percent presented with a non-ST-elevation ACS and 54% underwent CABG. More non-ST-elevation ACS patients underwent CABG versus PCI (70% versus 30%, $p<0.01$). All patients received ASA, but more CABG patients received 325 versus 80-81 milligrams (20% versus 1%, $p<0.01$). All PCI patients received a P2Y12 inhibitor (primarily ticagrelor) versus 24% of CABG patients (primarily clopidogrel). All CABG patients received a beta-blocker versus 97% of PCI patients. Use of ACEI/ARBs was higher in PCI versus CABG patients (99% versus 69%, $p<0.01$). Statin use was similar between groups (97% versus 99%, $p=0.45$), but more PCI patients received high-dose (91% versus 57%, $p<0.01$).

Conclusions: Use of ASA and beta-blockers post-ACS was high in both groups. P2Y12 inhibitors and ACEI/ARBs were underutilized in CABG patients even after adjusting for justified non-use, and CABG patients were less likely to receive high-dose statin therapy.

The Utilization of Mineralocorticoid Receptor Antagonists in Patients with Post ST-Elevation Myocardial Infarction Complicated by Left Ventricular Dysfunction

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Background: The EPHESUS trial demonstrated that early initiation of Mineralocorticoid Receptor Antagonists (MRAs) reduced mortality in post myocardial infarction patients with left ventricular ejection fraction (LVEF) ≤40% and documented heart failure (HF) or diabetes. Despite mortality benefits, it is hypothesized that MRAs are underutilized in a modern Percutaneous Coronary Intervention (PCI) center.

Objective: This study aims to determine any discrepancies between evidence-based guidelines and current prescribing rates of MRA.

Methods: A retrospective chart review was completed in a primary PCI center on all ST-elevation myocardial infarction (STEMI) patients from January 2016 to December 2016. Inclusion and exclusion criteria for MRA were applied based on those outlined in EPHESUS.

Results: A total of 670 patients presented with a STEMI during the study period. 451 patients did not meet criteria due to length of stay shorter than 3 days. 114 patients did not have a LVEF ≤40%. 72 patients had a false positive STEMI, 11 were non-diabetic with no HF symptoms. Ultimately, 22 patients were eligible for MRA therapy. Of those eligible, the mean age was 59, 86.3% were male, median length of stay was 4.5 days, mean LVEF was 35%, 63.6% had clinical evidence of HF, 54.5% were diabetic, and 18.2% were diabetic and had clinical evidence of HF. 81.8% with anterior infarct, 36.4% with inferior infarct, and 9% had both anterior and inferior infarct. Of the 22 patients eligible, 8 were prescribed MRA therapy. Of the 14 patients not prescribed MRA, 2 were hypotensive while 12 had undocumented reasons.

Conclusion: Despite mortality benefits of MRAs, a care gap exists between evidence-based guidelines and current practice. Reasons for MRA underutilization need to be further studied and addressed. As a result, we are creating pharmacist-implemented initiatives in our practice to raise awareness of MRA indications around healthcare providers and patients.

An Assessment of Modifiable Risk Factor Management in Hospitalized Patients with Type 2 Diabetes Mellitus

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Background: Treating to targets for glycated hemoglobin (A1C), low-density lipoprotein cholesterol (LDL-C) and urine albumin-creatinine ratio (ACR), reduces the risk of micro and macrovascular complications in patients with type 2 diabetes mellitus (T2DM). Evidence from primary care populations shows a persistent gap in the proportion of patients achieving targets and limited evidence is available to demonstrate interventions during hospitalization.

Objectives: Determine the current rate of control of diabetes-related risk factors in an inpatient population with T2DM and identify if target medications are initiated during hospitalization.

Methods: A retrospective assessment of the medical records of patients 40 to 75 years of age with T2DM, taking oral anti-hyperglycemic agents, who had been admitted to hospital with a minimum duration of stay of 72 hours.

Results: Of 193 patients included, A1C, LDL-C, and ACR was obtained in 182/193 (94.3%), 156/193 (80.8%), and 121/193 (62.7%) and 88/182 (48.4%), 87/156 (55.8%), and 52/121 (43.0%) with available laboratory data achieved targets in the year prior to hospital discharge, respectively. Use of oral anti-hyperglycemic medications, statins and/or ezetimibe, and angiotensin converting enzyme inhibitors (ACEI) or angiotensin-II receptor blockers (ARB) showed absolute increases of 10.9%, 7.7%, and 0.5% respectively during hospital admission; however, 22/69 (31.9%) and 5/69 (7.2%) were discharged without statins and/or ezetimibe or ACEI/ARB, respectively.

Conclusions: There is room for improvement in the rate of control of diabetes-related risk factors in hospitalized patients with T2DM in acute

care facilities within Regina Qu'Appelle Health Region. Although hospital practitioners are initiating some patients on target medications during hospitalization, comprehensive multidisciplinary strategies should be implemented to close the treatment gap and align care with evidenced based guidelines to prevent patient morbidity and mortality.

The Antithrombotic Treatment of Patients with Atrial Fibrillation Undergoing Percutaneous Coronary Intervention

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Background: Determining the optimal antithrombotic regimen for patients with non-valvular atrial fibrillation (NVAF) undergoing percutaneous coronary intervention (PCI) is challenging. Recent literature suggests that dual therapy (DT: oral anticoagulant + P2Y12 inhibitor) may have similar efficacy with less bleeding compared to triple therapy (TT: oral anticoagulant + P2Y12 inhibitor + ASA).

Objective: The main objective of this study was to characterize recent practice patterns in this patient population.

Methods: A retrospective chart review of patients with NVAF who underwent PCI with stenting at a Canadian, academic, tertiary care centre between September 1, 2016 and January 31, 2018 was completed. An electronic survey was sent to cardiologists to better understand prescribing rationale. Study results were reported using basic descriptive statistics including frequencies and percentages, with continuous variables presented as means ± standard deviations.

Results: Of the 107 patients included in the chart review, 71 (66%) had an admission diagnosis of acute coronary syndrome. At discharge, 19 patients (18%) were prescribed TT, 48 (45%) were prescribed DT, and 40 (37%) were prescribed dual antiplatelet therapy (DAPT: ASA + P2Y12 inhibitor). The decision of whether to anticoagulate was deferred to another hospital in 15% of DAPT cases. The average planned duration of TT, when prescribed, was 3.9 months. Of the 65 patients discharged directly home, a clear plan, including timeframe, for family doctor and cardiologist follow-up was documented in 54% and 74% of cases, respectively. Of 32 cardiologists, 8 (25%) responded to the survey. All 8 respondents agreed that recent literature has influenced their practice.

Conclusions: Overall, antithrombotic therapy was prescribed by a tailored approach, consistent with the most recent Canadian Antiplatelet Guidelines. The less intense regimen of DT was the most common antithrombotic regimen, illustrating rapid translation of recent literature into clinical practice. This study identified opportunities to improve antithrombotic practice patterns.

A Retrospective, Observational Study of the Management of Patients Hospitalized with Heart Failure with Reduced Ejection Fraction

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Background: Guideline directed medical therapy (GDMT) at target doses has been shown to improve survival in heart failure with reduced ejection fraction (HFrEF) and quality indicators exist to measure adherence to guidelines. In Regina, SK, HFrEF is a priority initiative, but it is unknown how patients are being managed.

Objective: To assess practice for alignment with evidence based medication-related recommendations for patients admitted with an exacerbation of HFrEF to an acute care hospital in Regina.

Methods: A retrospective review of inpatient medical records was completed. Patient selection was designed to include only ideal candidates, excluding patients with known contraindication to components of triple medication therapy and whose HFrEF diagnosis was less than six months to allow time to initiate and titrate medications.

Results: Out of 99 patients included, less than half (45.5%) were prescribed triple medication therapy at discharge, with 82 (82.8%) patients on an angiotensin converting enzyme inhibitor (ACEi), angiotensin II receptor antagonist (ARB) or angiotensin receptor neprilysin inhibitor (ARNI), 93 (93.9%) on a beta blocker (BB), and 53 (53.5%) on a mineralocorticoid receptor antagonist (MRA). Target dose was achieved for 36/81 (44.4%) patients on an ACEi, ARB or ARNI, 19/92 (20.5%) on a BB, and 3/53 (5.7%) on an MRA. Sixty-four (64.5%) patients were directed to follow up with their primary care provider, 49 (49.5%) with a cardiologist, and 14 (14%) with the Heart Function Clinic. Over 12 months, 45 (45.4%) patients were admitted 2 or more times for a HFrEF exacerbation. Thirty-one pharmacist interventions were documented for 18 (18.2%) patients.

Conclusions: Although many patients may be receiving the benefits of GDMT, there is a treatment gap in the management of patients admitted with HFrEF exacerbations in Regina. Health care providers should take every opportunity to enhance utilization and titration of GDMT to reduce morbidity and mortality.

Evaluation of a Pharmacist-Led Antimicrobial Stewardship Service in a Pediatric Emergency Department

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Background: We implemented a pharmacist-led antimicrobial stewardship (AMS) service for patients discharged from the pediatric emergency department (PED). This service, supported by a collaborative practice agreement, allows pharmacists to follow up with patients and independently stop, start, or adjust antimicrobial agents based on culture results.

Objective(s): The primary objective of our study was to evaluate the impact of this service on the rate of return visits to the PED within 96 hours. The secondary objective was to evaluate the appropriateness of the prescribed antimicrobial agent at follow up.

Methods: This study was completed as a retrospective chart review 6 months pre-implementation (January 1st, 2016 to June 31st, 2016) and 6 months post-implementation (February 1st, 2017 to July 31st, 2017) of a pharmacist-led AMS service. A research assistant extracted data from electronic medical records using a standardized data collection form. All patients discharged from the PED with a suspected infection whose cultures fell within the parameters of the collaborative practice agreement were included in this study. Data were reported descriptively and compared using a two-sided chi-square test.

Results: This study included 1070 patient encounters pre-implementation and 1040 patient encounters post-implementation of the AMS service. The most commonly reviewed culture was urine (38% pre-implementation and 41% post-implementation). The rate of return visits to the PED within 96 hours was 12.0% (129/1070) pre-implementation vs 10.0% (100/1049), p = 0.07 post-implementation phase. A significantly

higher percentage of inappropriate antimicrobial therapy was identified at the time of follow up in the pre-implementation phase (7.0%, 68/975) compared to the post-implementation phase (5.0%, 46/952), p = 0.047.

Conclusion(s): Although this pharmacist-led AMS service did not affect the rate of return visits within 96 hours, it may lead to more judicious use of antimicrobial agents in a PED.

Evaluating the Impact of Prospective Audit and Feedback on the Use of Clindamycin and Quinolones in Clinical Teaching Units

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Background: Antimicrobial usage of quinolones and clindamycin was noted to be greater on the general medicine units of a large academic hospital. The Antimicrobial Stewardship Program (ASP) implemented a prospective audit and feedback (PAF) strategy to optimize prescribing of these agents given their propensity to cause *Clostridium difficile* infection (CDI). In this study, the impact of PAF interventions on quinolone and clindamycin use was evaluated.

Objective: To evaluate the impact of the PAF interventions on the use of clindamycin and quinolones, and the incidence of CDI on clinical teaching units (CTU) at a multi-site tertiary care centre.

Methods: A PAF was introduced in April 2015 at a large academic health centre with two campuses (sites) housing six Clinical Teaching Units for general medicine patients. Using a face-to-face PAF model, medical teams (consisting of a senior medical resident and a pharmacist) to review patients receiving antimicrobials twice weekly. Clindamycin and quinolone utilization were compared using defined daily doses (DDD) per 1000 patient days pre and post-intervention. CDI rates were also monitored.

Results: There was an overall reduction in quinolone use by 68.2% and 75.4% in Site 1 and 2, respectively. Clindamycin use decreased in the first year at both sites by 50.5% and 30.8%, respectively. As the use of both antimicrobials decreased, the corresponding CDI rates at both sites also decreased.

Conclusion: The implementation of PAF intervention has reduced the use of clindamycin and quinolones as well as the incidence of CDI in our centre.

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

A Retrospective Analysis of the Management of *Staphylococcus aureus* Bacteremia

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Background: Staphylococcus aureus bacteremia (SAB) is the most common blood infection in Ontario and is associated with a high risk of morbidity and mortality. Adherence to management standards (i.e. echocardiography, appropriate antibiotic therapy, repeat blood cultures, and infectious disease (ID) consultation) have been shown to reduce mortality and recurrence.

Description: The objective of this study was to assess clinical outcomes and adherence to management standards in patients with SAB at an Ontario hospital.

Action: A retrospective chart review was conducted. Patient records were included if the patient had at least 1 positive blood culture for *S. aureus* from 30 August 2015 to 29 August 2016. Patients were excluded if they were aged <18, or died, were discharged, or deemed palliative within 2 days of blood culture collection. Collected data included patient demographics, antibiotic treatment, investigations, ID consultation, and clinical outcomes.

Evaluation: Of the 76 SAB patients included in the analysis, 34 (45%) received echocardiogram, appropriate antibiotic therapy, and repeat blood culture. Transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) were performed in 64 (84%) and 19 (25%) patients, respectively. We found that 67 (87%) patients received appropriate empiric and definitive antibiotic therapy, and 41 (54%) had an appropriate duration of therapy. Repeat blood cultures were performed in 63 (83%) of patient and ID consultation was provided for 33 (43%) of patients. Overall, 10 (13%) patients died and 3 (4%) experienced recurrence within 90 days of a positive blood culture.

Implications: Adherence to each management standard varied. The lowest adherence was associated with TEE, appropriate duration of antibiotic therapy, and ID consultation. Opportunities exists for pharmacist-driven initiatives to improve clinical outcomes and adherence to standards of care in the management of SAB.

Process Measures Associated with a Successful Antimicrobial Stewardship Intervention to Stop a *Clostridium difficile* Outbreak

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Background: Antimicrobial Stewardship Programs (ASPs) often use audit and feedback to optimize antimicrobial use for individual patients, which can lead to decreased unnecessary antibiotics and decreased *C.difficile.* ASP interventions have been described as a successful tool to halt *C.difficile* outbreaks, but there is limited data on specific process measures.

Description: We describe process measures associated with a successful *C.difficile* outbreak control strategy (collaboration between ASP and infection control [IC]) on an inpatient, nephrology unit at an urban teaching hospital. *C.difficile* cases increased from baseline starting November 2015; increased IC was implemented in May 2016. An official outbreak was declared June 2017, and the outbreak team was expanded. ASP Audit and Feedback was implemented May to December 2017.

Action: During ASP implementation, a dedicated ID clinical pharmacist and ID physician rounded with the nephrology multidisciplinary team (pharmacists, nurse practitioner, and nephrology physicians) three times per week to review all antimicrobial prescriptions. The ASP provided advice with attention to avoiding high-risk *C.difficile* antimicrobials and unnecessary antimicrobials; the outbreak was declared over September 15, 2017.

Evaluation: In total, 151 suggestions were made to the nephrology multidisciplinary team. Results are presented in the Table. Approximately one-quarter of recommendations decreased overall antimicrobial exposure (ie. discontinue, or narrow); one-quarter required escalation of a complicated case to the ID consultation service; and 14% were non-drug-therapy related (ie. laboratory/diagnostics).

Implications: We have described process measures that were associated with successful cessation of a *C.difficile* outbreak in a high-risk population at our institution. ASPs can utilize these process measures in future planning of outbreak management strategies.

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

Severe Allergic Reaction Induced by Dexlansoprazole: A Case Report and Literature Review

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Background: Proton pump inhibitors (PPIs) are one of the most worldwide prescribed drugs and represented twenty-two percent of the medication used in Quebec in 2010. We report a case of hypersensitivity with the Dexlansoprazole, belonging to the new generation of PPIs and marketed in Canada in 2010.

Case Description: A 24-year-old Canadian woman patient underwent an adverse drug reaction related to dexlansoprazole. Fifteen minutes after oral ingestion of 60mg of dexlansoprazole, she experienced burning sensations in both feet and hands. Then, she suffered from several vomiting, a coalescing maculopapular rash on almost 100% of her body surface ten seconds after vomiting and a swelling of her face and tongue, as far as partially obstructing her airways. She also passed out twice before her admission to the emergency room. After receiving intraveinous shots of dyphenhydramine, solumedrol, famotidine and ondansetron, she has completely recovered. She was discharged after a 4 hours observation period.

Assessment of Causality: Both the Naranjo (score of eight) and the Koh et Li (score of nine) scores show a probable imputability of the drug. Skin prick tests with lansoprazole and dexlansoprazole were performed. Only dexlansoprazole prick test was positive. Two months before, our patient had suffered from a primary exposure with the dexlansoprazole who has also led after fifteen minutes to burning hands and feet. This previous reaction was resolved in thirty minutes without any treatment.

Literature Review: We carried out a literature review using Pubmed, CINAHL and Google scholar databases. No case report about hypersensitivity related to dexlansoprazole was found. However, about sixty clinical cases of hypersensitivity were listed with all PPIs. Hypersensitivity with its stereoisomer, Lansoprazole, is one of the most described one.

Importance to Practitioners: To our knowledge, this is the first case report concerning anaphylactic reaction with Dexlansoprazole in the literature.

Environmental Contamination with Nine Antineoplastic Drugs in 79 Canadian Centers

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Background: Antineoplastic drugs traces are measured on many surfaces in healthcare centers. Workers occupationally exposed to these traces are at risk of adverse health effects. In order to reduce their exposure, surface contamination should be kept as low as possible.

Objective(s): 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: Seventy-nine Canadian centers participated in 2018. A total of 887 surfaces were sampled, 467 in pharmacy and 420 in patient care areas. Cyclophosphamide was most often measured on surfaces (32% positive samples, 75th percentile = 0.0017 ng/cm², 90th percentile = 0.021 ng/cm²). The front grille inside the hood (81% of samples positive for at least one antineoplastic drug), the arm rest (79%), the storage shelf (62%) and the floor in front of the hood (60%) were more frequently contaminated. 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 ($p<0.0001$).

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

Adverse Effects of High-Dose vs Standard-Dose Dexmedetomidine in the Cardiac-Surgery Population: A Retrospective Cohort Study

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Background: Dexmedetomidine is a selective alpha-2 agonist with minimal respiratory depression compared to other sedatives; it is used to facilitate extubation and to treat delirium in the critically-ill. The dexmedetomidine monograph recommends a dose of 0.2-0.7mcg/kg/hr but higher doses have been used in practice. It is not known whether higher-than-recommended doses of dexmedetomidine are safe in cardiac surgery patients. Higher doses have not been studied in this patient population who are potentially at higher risk for adverse effects due to recent myocardium manipulation and hemodynamic instability.

Objective: To determine whether there is an increased risk of hypotension or bradycardia with higher-than-recommended doses of dexmedetomidine in cardiac surgery patients.

Methods: We conducted a retrospective cohort study of patients who received dexmedetomidine for any indication following cardiac surgery at our hospital between 2013 and 2017. The primary outcome was the rate of hypotension or bradycardia for high-dose (>1.0mcg/kg/hr) vs standard-dose (≤1.0mcg/kg/hr) dexmedetomidine. Secondary outcomes included individual rates of hypotension, bradycardia, arrhythmias, and hyperglycemia in the high-dose vs standard-dose groups.

Results: Among 245 patients included, 49 received high-dose and 196 received standard-dose dexmedetomidine. Mean doses of dexmedetomidine in the high-dose and standard-dose groups were 0.79±0.18mcg/kg/hr and 0.45±0.06mcg/kg/hr respectively. For the primary outcome, 36 (73.5%) patients in the high-dose group and 128 (65.3%) in the standard-dose group experienced hypotension or

bradycardia (OR=1.48, p=0.340, 95% CI: 0.7-3.4). In the high-dose group, there were more episodes of transient bradycardia (<1hr): 6 (12.2%) vs 2 (1.0%), and more hypotension: 36 (73.5%) vs 128 (65.3%).

Conclusion: This is the first known study of high-dose dexmedetomidine after cardiac surgery. The results may suggest that the rate of hypotension or bradycardia may be slightly higher with high-dose dexmedetomidine compared to standard-dose, but this did not reach statistical significance.

Capturing Medication Safety Culture in Saskatchewan Pharmacies Using the Medication Safety Culture Indicator Matrix

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Background: Standardized continuous quality improvement (CQI) programs are employed to assist pharmacies in recognizing medication incidents and developing solutions to prevent them. It is important to understand where practice culture surrounding medication safety stands to better support this endeavour.

Description: The objectives of this study were to explore the medication safety culture in Saskatchewan pharmacies and identify whether pharmacies currently held a "blame-and-shame" (i.e. pathological) or "systems-oriented" (i.e. generative) attitude towards safety.

Action: The Medication Safety Culture Indicator Matrix (MedSCIM) tool, developed by the Institute for Safe Medication Practices Canada (ISMP Canada), was used to analyze two sets of medication incidents reported by pharmacies in Saskatchewan from September 2013 to October 2017: one set was associated with patient harm, while another set contained randomly selected incidents from the top three types of medication incidents.

Evaluation: We analyzed 140 harm incidents: 42.8% of the reports were fully complete, 51.4% semi-complete, and 5.7% not complete. Of the 158 randomly selected top three types of incidents, 5.69% were fully complete, 70.25% semi-complete, and 24.05% not complete. Within the harm incidents, 13.5% implied a "blame-and-shame" culture, 40% reflected "reactive", 30% indicated "calculative", and 16.5% supported a "generative" safety culture. On the other hand, "blame-and-shame", "reactive", "calculative", and "generative" safety culture were represented by 9.49%, 85.44%, 3.79%, and 1.26%, respectively, of the randomly selected top three types of incidents.

Implications: Our MedSCIM analysis reveals that there is still work to be done to facilitate medication safety culture towards a more "systems-oriented" or "generative" attitude and it appears that pharmacy professionals tend to do so more often if patient harm is involved in the incident. Our study offers a baseline of medication safety culture in Saskatchewan pharmacies as the provincial mandatory standardized CQI program is being rolled out in 2018.

Analyse descriptive des incidents et accidents médicamenteux de 2011 à 2018 dans un centre hospitalier

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Contexte : Depuis 2002, un processus structuré de déclaration des incidents et accidents (IA) en établissement de santé a été mis en place au Québec.

Objectif(s) : Décrire et commenter l'évolution des IA médicamenteux (IAM) du 1er avril 2011 au 31 mars 2018 au sein centre hospitalier universitaire.

Méthodologie : Étude descriptive rétrospective. À partir du registre local des IA, nous avons extrait, par année financière, tous les IAM incluant les variables suivantes : gravité (selon NCCMEPR), quart de travail de survenue, catégorie (médication), circonstance, description et la présence d'un médicament à haut risque.

Résultats : Un total de 41350 IA a été déclaré de 2011 à 2018 incluant 12881 IAM (31%). La répartition des IAM selon la gravité est : A(5%), B(14%), C(67%), D(9%), E(5%), F(n=9), G(n=0), H(n=0), I(n=2). Les IAM surviennent de jour (36%), de soir (31%) ou de nuit (33%). Le top-5 des circonstances identifiées inclut: médicaments non administré (22%), mauvaise posologie du médicament administré (21%), mauvais horaire d'administration (10%), mauvais médicament administré (8%) et extravasation du médicament (5%) et autres (34%). Les médicaments à haut risque (MHR) représentent 15%(1902/12881) des IAM. Le top-10 des MHR représentés inclut: morphine (n=497), héparine (n=262), hydromorphone (n=216), fentanyl (n=139), kétamine (n=124), enoxaparine (n=62), milrinone (n=56), méthotrexate (n=44), daltéparine (n=41), acétaminophène-codéine (n=31). Le nombre d'IAM déclarés par année diminue à partir du 1er avril 2014.

Conclusion(s) : Les IAM représentent une part importante des IA en établissement de santé. Toutefois la majorité des IAM ne comportent pas de conséquences pour le patient. Les médicaments à haut risque occupent une place importante dans les déclarations des IAM. L'étude ne permet pas d'identifier de causes certaines liées à la diminution du nombre d'IAM déclarés au cours des dernières années.

Comparative Evaluation of Intentional versus Unintentional Medication Discrepancies during Admission Medication Reconciliation

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Background: During admission medication reconciliation (MedRec), proactive model may include documented intentional medication discrepancies (DIMD), while retroactive model can experience the occurrence of both DIMD and unintentional medication discrepancies (UMD). In the literature, studies comparing and analyzing DIMD and UMD in both such models are scarce.

Objective: The aim of this study was to analyze and quantify both DIMD and UMD in both models of MedRec.

Methods: This comparative analysis included patients previously enrolled in a prospective, observational study that was conducted at Regional Hospital from May to June 2018. The primary end point was to identify the frequency of DIMD and UMD. The secondary end point was to discern the frequency and type of medication classes and the reasons associated with each type of discrepancy.

Results: After reviewing 249 medication reconciliations, 180 patients were enrolled. Of those, 84 patients received the proactive MedRec, while 96 patients received the retroactive model. The total number of medications reconciled was 2118. The percentage of DIMD in the proactive model was significantly more than that in the retroactive model

(16.3 % vs. 7.3 %, respectively; P <0.001). In the retroactive model, the UMD were significantly more than the DIMD (25.1 % vs. 7.3 %, respectively P = 0.0003). The most common reason for DIMD was withholding home medication; there was no difference between the retroactive and proactive models (23.8% vs 26.9% P=0.59). Cardiovascular drugs were the most common class involved in DIMD for both models. The most common UMD was omission (78.8%) and the most common class was gastrointestinal agents in the retroactive model.

Conclusion: This study demonstrated that the proactive model had a positive impact on reducing the medication errors associated with late DIMD or UMD.

Transition of an Independent Website for a Professional Association Branch to a Microsite Integrated within the Website of the Parent Organization

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Background: The Saskatchewan branch of the Canadian Society of Hospital Pharmacists (CSHP) independently operated a website for communication with local members. Functions included: advertising events, awards, residency programs; newsletter distribution; sharing policies, procedures, contact information, including forwarding email addresses; members-only access to meeting minutes and resources. CSHP presented the branch with the opportunity to develop a subsection, or "microsite", within its website. Benefits included sharing resources and lowering expenses; known challenges to microsite operation included loss of autonomy, due to need for a centralized website administrator. The branch elected to exercise the option. A transition working group was formed.

Description: The unique situation presented a rare opening to review existing website functions and content prior to migration. An engagement strategy was used to inform development.

Action: Two online surveys were conducted. A volunteer survey was used to determine communication needs of branch council members. A branch member survey was used to determine uses for a branch website. Findings aided in development of council contact mechanisms (eg, email addresses), site navigation, and determining which content would be migrated, eliminated, or would need to be created. Progress was periodically shared with branch council for feedback and guidance in navigating obstacles.

Evaluation: Thirteen of 19 branch council members responded to the first survey. Branch email addresses were rarely used by council members. Only three positions required such addresses: president, communications chair, and fundraising coordinator. A fourth address was eventually added to facilitate award nominations. An address naming convention was established. Forty-seven responses (approximately 20% of branch members), were received from the second survey. The main reasons reported for using the website included events, awards, and contact information, and to read branch news.

Implications: The information gathered increased the likelihood that the new website's function and content aligns with the needs of branch council and members.

Opioid Stewardship: Implementing Proactive, Pharmacist-Led Reviews for Patients Co-Prescribed Opioids and Benzodiazepines at an Urban Academic Family Health Team

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Background: In 2017, almost 4,000 Canadians died from opioid-related causes. Co-administration of opioids and benzodiazepines is a risk factor for overdose. Primary care pharmacists, functioning as opioid stewards, could address co-prescribing; however, implementation has not been characterized.

Objective: To implement proactive, pharmacist-led reviews of patients with chronic non-cancer pain co-prescribed opioid(s) and benzodiazepine(s).

Methods: A quality improvement approach, utilizing Plan-Do-Study-Act methodology, was employed from November 2017 to May 2018. Four Plan-Do-Study-Act cycles were conducted across two academic family health team sites associated with a tertiary care medical centre in Toronto. The intervention consisted of a pharmacist: (1) identifying patients through medical record queries; (2) developing care plans; (3) discussing recommendations with prescribers; and (4) discussing implementation with patients. The intervention was refined, according to prescriber and patient interviews, to have the pharmacist: (1) engage with physicians in-person; (2) review all a physician's co-prescribed patients with them in a single meeting; (3) increase their visibility; and (4) provide education on pharmacists' scope of practice. Outcome, process, and balancing measures were collected monthly.

Results: Thirty-five patients (100%) were assessed by the pharmacist. There was an increase in the number of patients with pharmacist involvement in their pain management from 5 (14%) at baseline to 23 (66%) post-intervention. Patients offered an opioid taper increased from 6 (17%) to 10 (29%) and those with an active taper increased from 2 (6%) to 8 (23%). Mean total daily opioid dose decreased 11% from 50.5 milligrams morphine equivalent (MME) to 44.7 MME. Mean total daily benzodiazepine dose decreased 8% from 9.9 milligrams diazepam equivalent (MDE) to 9.3 MDE.

Conclusion: The implementation of proactive, pharmacist-led reviews for co-prescribed patients was accepted. A new role for primary care pharmacists as opioid stewards exists. Future studies could expand to additional sites and patients with other risk factors for overdose.

Optimizing Patient Education of Oncology Medications: A Quantitative Analysis of the Patient Perspective

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Background: With the ever-increasing complexity of cancer treatments, oncology medication patient education is becoming a progressively important component of cancer care. Education increases patients'

abilities to make informed decisions, increases medication adherence, decreases feelings of anxiety and depression, improves patient satisfaction, and allows patients to feel a sense of control. Despite this, cancer patients frequently report that they receive inadequate information and feel that their education needs have not been met.

Objective: To explore patients' perspectives of optimal oncology medication education across Nova Scotia.

Methods: A descriptive survey of adult oncology outpatients. Participants included adult medical, hematological and gynaecological oncology outpatients receiving intravenous chemotherapy within Nova Scotia Health Authority between January 26 and April 30, 2018.

Results: One hundred forty-two responses were included. Forty-one percent and 47 % of respondents reported being satisfied or very satisfied with their oncology medication education, respectively. Thirty percent and 43 % of respondents would like the opportunity to receive education or follow-up from a hospital pharmacist, respectively. Respondents with post-secondary education were found to have 2.82 higher odds of wanting to make an appointment for education with a hospital pharmacist. Respondents with a hematological malignancy were found to have 9.23 higher odds of receiving education from a hospital pharmacist.

Conclusions: Patients were generally satisfied with their oncology medication education despite the majority not receiving education from a hospital pharmacist. Patients with a higher level of formal education were more likely to want the opportunity to schedule an appointment for education with and/or receive follow-up from a hospital pharmacist. The oncology medication education participants received in the past appears to align with their education preferences. Findings from this research can be used to optimize the limited time healthcare professionals have to provide meaningful and effective oncology medication patient education and improve patient-centered care.

Development of Candidate Choosing Wisely Recommendations for a Professional Society

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Background: Choosing Wisely Canada (CWC) is a campaign to help patients and clinicians make care choices. CWC partners with professional societies to develop recommendations regarding potentially unnecessary tests and treatments: those not supported by evidence and could result in harm to patients.

Description: The Excellence Initiative Steering Committee of the Canadian Society of Hospital Pharmacists (CSHP) undertook a campaign to develop CWC recommendations that represent the unique voice of pharmacists from hospitals and related health care settings.

Action: A working group was formed. An initial list of recommendations was elicited from members via promotion at CSHP conferences and through an online survey. Suggested recommendations were compiled and duplicates were removed or combined. The remaining were sorted into two categories: 'medication-based' (recommendations), those specific to a medication or group; 'practice-based', those related to general principles of medication therapy. A second survey asked members to rank their 'top five' from each category, resulting in a short-list of contenders. Evidence supporting each was curated. Comparing supporting literature and considering potential for overlap or redundancy (with self and other professional societies) resulted in contenders being removed or combined to make the final list of candidate recommendations. These were presented to the CSHP board for approval before submission to the CWC publication process.

Evaluation: The first member survey resulted in 184 suggested recommendations from 65 members. Seventeen medication-based and 14 practice-based recommendations were re-circulated to membership through the second survey, garnering responses from 263 members. Eleven recommendations distinctly represented member input. Seven recommendations, with accompanying supporting literature, were presented to the board.

Implications: Developing the list of candidate recommendations was an opportunity to engage all members in an initiative to improve patient care. The CWC campaign provides a rare platform for professionals to share with each other, the public at large, and the patients for whom they provide care.

The Impact of Delisting Docusate from a Hospital Formulary

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Background: Docusate is frequently prescribed to manage constipation despite being no more effective than placebo. Docusate contributes to polypharmacy and medication costs, increases healthcare provider workload and delays initiation of effective treatments. Consequences of inadequately treated constipation include fecal impaction and bowel obstructions. This study examines the impact of delisting docusate from the formulary at our institution in November 2015.

Objectives: To determine change in volume of dispensed doses of laxatives in the year following the delisting of docusate. Impact on acquisition costs of other laxatives and incidence of negative sequelae of constipation were secondary objectives.

Methods: Statistical process control methods were applied to examine dispensing patterns of bowel medications in the years preceding and following the intervention of delisting of docusate from the formulary. Control charts were created using monthly dispensed volumes of sennosides, lactulose, polyethylene glycol, magnesium hydroxide, bisacodyl and glycerin suppositories. Significant changes were defined as data exceeding upper and lower control limits. Monthly acquisition drug costs and incidence of bowel obstructions using ICD-codes were retrieved, tabulated and analyzed for change before and after the intervention.

Results: In the year following delisting of docusate, monthly dispensed volumes of each bowel medication were within the upper control limits of the XmR control charts, indicating no significant increase in use. Prior to the intervention, 244 combined intestinal obstructions and impactions were recorded. This decreased to 210 in the year following the delisting. In the year preceding delisting, $5,075 was spent on docusate. Total costs for bowel medications of interest before and after the intervention were $23,969 and $17,674, respectively.

Conclusions: This study supports removing docusate from hospital formularies. In the year following delisting, no significant increases in dispensing volumes of bowel medications were observed. This intervention did not increase drug costs or rates of bowel obstruction at our institution.

Pharmacist Review of Computer Physician Medication Order Entry in Hospitals: A Prospective Observational Study of Pharmacist Interventions

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Background: Medication safety standards for hospitals require pharmacist review of all medication orders (MO) before the first dose is administered. With the advent of computer-based physician order entry systems (CPOE) embedded with clinical decision support software, the need for pharmacist MO review is occasionally questioned.

Description: This prospective observational study involved telepharmacist review of CPOE from 2300-0700H in a group of 12 specialty and community hospitals (28-403 beds) utilizing 24 hour telepharmacy services over 10 months, 3 years following the introduction of a shared CPOE system with clinical decision support.

Action: During pharmacist CPOE review, MOs requiring intervention by the pharmacist and the reason for the intervention was recorded.

Evaluation: A total of 40,982 CPOE MO's were reviewed for accuracy and appropriateness by the telepharmacist. Of these, 5287 (12.9%) had a problem identified that required pharmacist intervention (correction). Of the MOs requiring intervention, the most common was missing or incorrect assignment of the medication to a specific drug product or dosage form, 2319 (44%) orders. In 1015 cases (19 %), the MO was prescribed at the incorrect time or frequency. For 684 orders (13 %), the automatic therapeutic substitution of a MO to a medication on the hospital formulary list was unsuccessful. Duplicate MOs totaled 531 (10 %). The dose or dose unit was incorrect in 498 cases (9 %). A placeholder intended for a drug not contained in the system was used inappropriately when the prescribed drug was available in the system in 240 cases (5 %).

Implications: Even in hospital settings where a CPOE system with clinical decision support has been well established, a significant number of MOs show deficiencies. Review of CPOE by a pharmacist before the first dose of a medication is administered is an essential requirement to ensure the safety of drug therapy in hospitals.

Determining Patient and Caregiver Values and Needs from an Outpatient Oral Anticancer Therapy Program: A Qualitative Needs Assessment

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Background: Anticancer treatment is increasingly shifting towards orally administered medications. As treatment moves out of cancer centres and into patients' homes, medications will need to be managed more independently. However, health authorities have identified that patient supports for managing take home anticancer treatment are currently inadequate. In response, many cancer centres have developed oral anticancer therapy programs to improve care. A needs assessment of this patient population is warranted to inform foundational components of an effective oral anticancer therapy program.

Objective: To determine patient and caregiver values and needs from an oral anticancer therapy program.

Methods: A single-centre, qualitative, descriptive study was conducted in an outpatient cancer centre at a tertiary care hospital between March 19 and May 18, 2018. Adult patients receiving oral anticancer therapy for a malignant indication were eligible for recruitment. Data were collected through semi-structured interviews that were audio-recorded and transcribed. Transcripts were analyzed using conventional content analysis to generate codes and establish prominent themes.

Results: Twelve interviews were conducted (mean age 66 years) and a total of nine different oral agents were captured. Four major themes were identified: 1) methods of information and education delivery, 2) drug access concerns, 3) baseline medication concerns; and 4) value of convenient and collaborative cancer care.

Conclusion: Patients desired medication information, particularly concerning efficacy and common side effects, to be delivered in written format. Delays in access to drug therapy were a frequent source of concern. Lastly, convenient and seamless continuity in care is valued and enhances the overall experience with the cancer care system. Results from this study will be used to guide quality improvement initiatives within our institution's oral anticancer therapy program.

Telepharmacist Medication Order Review: A Prospective Observational Study in Healthcare Systems

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Background: Up to 15% of medication orders have a prescribing error (RxE), affecting 1/3 of patients during their hospital admission. RxEs cause significant health and economic consequences: increased health-care utilization, morbidity and mortality. A successful intervention to reduce RxEs is pharmacist medication order review (PMOR) prior to the administration of the first dose. Despite RxE frequency and improved patient safety with PMOR, hospital pharmacy hours in Canada average 79 h/week (47% of the time). Moreover, in small hospitals, PMOR occurs in 60% of prescriptions prior to administration of the first dose. In the US, 79% of hospitals have 24/7 PMOR, 20% supported by telepharmacy. Telepharmacist services have demonstrated a positive impact on PMOR, patient safety, and healthcare costs. Data on telepharmacy PMOR in Canada are lacking.

Description: This 28-day prospective observational study included 47 pharmacists performing PMOR in 25 health care sites, ranging from 18-389 beds utilizing 24-hour telepharmacy services.

Action: During PMOR telepharmacists documented: facility, software system, type of PMOR (pharmacist order entry or, verification of technician, RN or prescriber entry), time block, total number of orders reviewed and time required for PMOR. Categorical and continuous data were described using descriptive statistics and tests for association.

Evaluation: Pharmacist performed PMOR for 1095 orders in a median time of 1.3 min/order. Meditech® (Client 35%, DOS 24%) was the most common software system. Monday-Friday accounted for the majority of PMOR (20, 17, 21, 17, and 15 % respectively). The busiest time block was 8 am-12pm (39%). Significant differences were found in time/order for: time blocks (daytime vs evening/night/weekends, daytime), software systems, and PMOR (pharmacist order entry vs. verification and entry verification technician, RN, prescriber).

Implications: Data on telepharmacy services will allow both Telepharmacy providers and healthcare leadership to make informed decisions on PMOR around the clock to improve patient outcomes.

Patients' Perspectives on a Self-Administration of Medication Program in a Rehabilitation Hospital

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Background: A self-administration of medication program (SMP) is designed to help patients learn to manage their own medications before discharge to the community. Previous studies on patient satisfaction with SMP reported mostly positive responses, but also some mixed findings.

Objective: To determine patients' opinions of a medication self-administration program in an inpatient rehabilitation setting.

Methods: Inpatients enrolled in an SMP in a rehabilitation hospital were invited to participate in a research study to evaluate patients' capacity to manage their medications. Following discharge, participants took part in a one month and six month follow-up telephone call to confirm medication regimens and adherence. A patient satisfaction survey was administered during the one month follow-up. Survey data were entered in a Microsoft Access database and summarized descriptively.

Results: There were 90 participants who consented to the study and met inclusion criteria. Patient satisfaction surveys were administered from January 6, 2017 to May 13, 2018, and 87 participants responded to the survey. Responses indicated that 97% of participants liked taking their own medications. The most common reasons reported were that the patients liked being independent, having control over their medications, and the SMP helped them understand why they were taking them. Other themes were helping nursing staff who were busy and establishing a medication-taking routine. Overall satisfaction rating indicated that 93% of survey participants were satisfied with the SMP; 6% felt neutral; and 1% felt somewhat dissatisfied. Patients who were dissatisfied noted that they preferred someone else administer their medications.

Conclusions: Patient feedback on the SMP was overall positive, and the ability to administer their own medications was valued. Survey data will be used to help determine the patient population who will most likely benefit from SMP and to improve program quality.

Clinical Burden of Antibiotic Resistance Following Implementation of a Multidisciplinary Antimicrobial Stewardship Initiative in a Major Tertiary Care Center: A Controlled Interrupted Time Series Analysis over 14 Years

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**Senior Author, now retired, affiliations at time of study completion; sequence determines credit approach to authorship*

Background: Reducing antimicrobial resistance (AMR) is a major incentive for institutional antimicrobial stewardship programs (ASPs). However, there remains a paucity of high quality data evaluating the impact of these programs on nosocomial AMR. The Sunnybrook Health Sciences Centre (SHSC) Bayview Campus is a shared site, home to a 627-bed acute care hospital and a 530-bed long-term-care facility (LTCF). A prospective audit-and-feedback (PAF) ASP was implemented in the acute care facility in October 2009. No specific intervention was initiated in LTCF, but there was potential for antimicrobial prescribing in the LTCF to be influenced by policy and practice at the adjoining acute care facility.

Objectives: The objective of this study was to evaluate the impact of the SHSC PAF-ASP on the burden of antibiotic-resistant organisms (ARO) and multidrug-resistant organisms (MDRO) and on inpatient antimicrobial (AMU) in the 7 years following program implementation.

Methods: Patient-level microbiologic and AMU data were retrospectively obtained over a 14-year study period (October 2002–September 2016). Interrupted time series Poisson regression models were used to detect PAF-ASP associated changes in the incidence and trend of hospital-acquired (HA-) ARO, HA-MDRO, and targeted (TGD) AMU and infer program impact. Changes in community-acquired (CA-) and long-term-care facility-acquired (LTCF-) ARO and MDRO were assessed for comparison.

Results: PAF-ASP implementation was associated with improvements in HA-ARO incidence (9.3% reduction/post-intervention period, $p<0.0278$), HA-MDRO incidence (12.6% reduction/post-intervention period, $p=0.1319$), and the trends of both outcomes. Improvement in TGD AMU, increases in CA-ARO and CA-MDRO incidence, and attenuated effects on LTCF-ARO and LTCF-MDRO incidence were found.

Conclusions: Implementation of the acute care PAF-ASP was associated with improvements in acute care AMR and AMU. The absence of improvement in corresponding CA-AMR outcomes, and limited improvement in the corresponding LTCF AMR outcomes, strengthen the causal inference of the acute care PAF-ASP curbing development of acute care AMR.

Ceftobiprole plus Vancomycin for the Treatment of Methicillin-Resistant Staphylococcus Aureus Infective Endocarditis: Case Report

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Background: Ceftobiprole is a cephalosporin antibiotic with broad coverage of gram-positive and gram-negative bacteria, including Methicillin-Resistant Staphylococcus Aureus (MRSA). It is indicated for hospital-associated and community-acquired pneumonia with ongoing trials exploring its efficacy in soft-skin tissue infections as well as MRSA bacteremia. We report a case of MRSA bacteremia secondary to infective endocarditis, successfully cleared with ceftobiprole and vancomycin combination therapy.

Case Description: A 75-year-old male presented to hospital with sepsis secondary to MRSA bacteremia. He was initially treated with vancomycin; however, repeat blood cultures were persistently positive for MRSA. Therapy was switched to a combination of cloxacillin and daptomycin. Despite modest clinical improvement, blood cultures remained positive. A transesophageal echocardiogram confirmed implantable cardiac defibrillator (ICD) infective endocarditis, without

vegetation. Because the patient remained bacteremic and had developed eosinophilic pneumonitis secondary to daptomycin, antibiotic therapy was changed to ceftobiprole and vancomycin. He clinically improved and blood cultures returned negative. The patient received 6 days of ceftobiprole, after which the ICD was extracted. Post ICD removal, therapy was changed to vancomycin, gentamicin, and rifampin for 6 weeks.

Assessment of Causality: During ceftobiprole therapy, the patient clinically improved. Positive blood cultures returned and remained negative. Vancomycin was unable to clear the bacteremia despite known sensitivity and therapeutic concentrations. As per the WHO-UMC causality system criteria, it is probable that ceftobiprole contributed to the microbiological cure of MRSA bacteremia.

Literature Review: Animal models have demonstrated synergy with vancomycin and ceftobiprole for infective endocarditis, as well as superiority as monotherapy for MRSA infection compared to vancomycin, daptomycin and linezolid. There is 1 published case report of clinical success with ceftobiprole as salvage therapy for prosthetic valve endocarditis.

Importance to Practitioners: Ceftobiprole provides a safe treatment alternative for MRSA infective endocarditis.

Antimicrobial Guideline Concordance is Low in Cancer Patients with Febrile Neutropenia Admitted to General Internal Medicine at an Academic Hospital

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Background: Febrile neutropenia (FN) is a medical emergency which can lead to significant morbidity and mortality for oncology patients. Institution-specific guidelines for febrile neutropenia (FN) have been recommended as an antimicrobial stewardship intervention in oncology patients to reduce unnecessary antibiotic use without adverse outcomes. Institution guideline specified empiric antimicrobials are piperacillin/tazobactam plus aminoglycoside in high-risk FN patients, and cefazolin plus aminoglycoside in low-risk FN patients. Meropenem is an accepted alternative for patients with self-reported penicillin allergies.

Objective: To evaluate guideline concordance and antimicrobial management in oncology patients admitted to the General Internal Medicine (GIM) unit at an academic hospital.

Methods: A retrospective observational study was conducted in patients admitted with FN from July 1, 2016 to June 30, 2017. Patients were classified as either low-risk or high-risk according to cancer diagnosis and chemotherapy received. The proportion of patients administered guideline-specified empiric antimicrobials within 48 hours of admission to GIM was the primary outcome. Secondary outcomes were proportion of patients whose empiric antimicrobials were active against pathogens isolated, rate of antimicrobial adverse events, and 30-day readmissions.

Results: One hundred patients were included, of which 34% (34/100) were low-risk FN and 66% (66/100) as high-risk FN. Antimicrobial management was guideline-concordant in 59% (59/100) of all admissions. In the low-risk group, guideline concordance was 35% (12/35), and in the high-risk group, 71% (47/66). Source of infection was identified in 50% (50/100), and empiric antimicrobials were active against 94% (17/18) of the pathogens isolated. Average length of stay was 6.6 ± 3.9 days, and 30-day readmission rate was 23% (23/100). Antimicrobial adverse events occurred in 16% (16/100) of admissions.

Conclusion: Guideline concordance in the antimicrobial management of FN patients is low in GIM at 59%. Future qualitative studies to identify factors influencing antimicrobial prescribing behaviours to improve knowledge translation are warranted.

Drug Utilization Evaluation of Ceftolozane/Tazobactam in a Canadian Academic Teaching Hospital System

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Background: Ceftolozane/Tazobactam (tol/taz) is a combination of a 3rd generation cephalosporin with beta-lactamase inhibitor licensed in Canada for treatment of complicated intraabdominal infections and complicated urinary tract infections. The efficacy of tol/taz against *Pseudomonas aeruginosa* has been demonstrated in vitro and in phase 3 trials. Phase 3 data for nosocomial pneumonia indications is pending. Understanding the role of tol/taz with respect to antimicrobial stewardship principles will be important.

Objective: To carry out a drug utilization evaluation of tol/taz in a Canadian academic teaching hospital system.

Methods: A pharmacy inventory usage report for 1 year from August 2017 to 2018 identified patients who received tol/taz. Patient electronic medical records were accessed to determine: indication/site of infection, dose, duration, causal organism, susceptibility, co-administered antibiotics, unit/ward, patient immune status, microbiological cure, hospital mortality, *C. difficile* infection, renal function.

Results: For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

Notable traits in the patient population receiving tol/taz were immunosuppression, renal dysfunction, and a high level of acuity, as indicated by the unit of patient admission. We used tol/taz for 11 patients with pleural infections, and 3 with complicated intra-abdominal infection. Microbiological cure was low at 19%, however hospital survival at 30 days was 88%.

Conclusion: Tol/Taz may be considered for formulary addition as an alternative agent when primary and secondary therapies have failed or resistance to these agents has been detected and documented. The use of tol/taz in our study was appropriate most of the time from an antimicrobial stewardship perspective. Factors limiting use include: development of *P. aeruginosa* resistance, lack of clinical data in patients with multiple comorbidities or renal dysfunction, cost, and lack of licensed indications for pleural infections.

A Retrospective Case Series Assessing Ceftolozane/Tazobactam Use at a Large Academic Centre

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Background: Ceftolozane/tazobactam is a novel cephalosporin and beta-lactamase inhibitor combination approved for the treatment of complicated urinary tract infections (cUTI) and complicated intra-abdominal infections (cIAI). It demonstrates activity against some strains of multi-drug resistant *Pseudomonas aeruginosa* (MDR-PS); however,

there is limited clinical experience in off-label indications such as pneumonia (PNA) or osteomyelitis (OM). Pharmacokinetic literature suggests that higher doses may be required for tissue penetration particularly in the lungs.

Objectives: The purpose of this retrospective study is to describe a case series of ceftolozane-tazobactam treatment and evaluate the clinical and microbiologic outcomes at a multi-site tertiary care institution.

Methods: A retrospective chart review was conducted on patients who were administered ceftolozane/tazobactam from June 2016 to May 2018. A predefined data collection form was used to gather patient, infection and treatment-related information. Data collection was summarized using descriptive statistics. Clinical failure was defined as mortality, discontinuation of drug or retreatment of index infection.

Results: Over 24 months, 9 patients received ceftolozane-tazobactam. Mean age was 55 and average Charlson Comorbidity Index was 13. The most frequently isolated pathogen was MDR-PS (8/9). Of the 5 patients with PNA, 3 patients experienced clinical failure, 1 was indeterminate, and 1 successfully cleared the infection with a higher dosing regimen. Of the 2 patients with cIAIs, both experienced clinical and microbiologic failure. The 2 patients with OM experienced both clinical and microbiologic success.

Conclusion: Ceftolozane/tazobactam was used for off-label indications predominantly in respiratory and bone infections where MDR-PS coverage was required. Further studies are needed to support optimization of indication based dosing.

Using Monte Carlo Simulation to Evaluate Tigecycline Dosing Strategies for Bacteria with Raised Minimum Inhibitory Concentrations in Non-Critically Ill Patients

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Background: Tigecycline is one of the few antibiotic options that exist for treating multi-drug resistant (MDR) gram-negative bacteria.

Objective: The objective was to use Monte Carlo Simulation (MCS) to determine if safe tigecycline dosing options that attained breakpoints for pharmacokinetic-pharmacodynamic (PK-PD) targets in non-critically ill patients could be identified.

Methods: Published studies were included if they evaluated clinically relevant tigecycline dosing regimens and provided mean PK variables of interest (at minimum 2 of: elimination rate constant (k^{-1}) or half-life ($t_{1/2}$), and volume of distribution (V_d) or clearance (CL)), with corresponding standard deviations (SD). Weighted mean and weighted SDs for each PK parameter were determined. Food and Drug Administration (FDA) minimum inhibitory concentration (MIC) tigecycline breakpoints for susceptible (MIC ≤ 2 µg/mL), intermediate (MIC 4 µg/mL), and resistant (MIC ≥ 8 µg/mL) *Enterobacteriaceae* were used. MCS probability distributions (1 million iterations) for PK-PD target attainment of area under the curve for total tigecycline plasma concentration from 0 to 24h following an intravenous dose ($AUC_{total, 0\text{-}24h}$) to MIC ratios of ≥ 18, 7 and 4.5 were generated; with success defined as a regimen with a probability of target attainment of at least 80% at a given MIC.

Results: Thirteen studies (n=497) were eligible for study inclusion. The use of intermittent infusion tigecycline 150mg IV q12h for ward patients with resistant gram-negative bacteria up to a MIC of 0.48 µg/mL for an $AUC_{total, 0\text{-}24h}$/MIC target attainment of 18, up to a MIC of 1 µg/mL for an $AUC_{total, 0\text{-}24h}$/MIC target attainment of 7, and up to a MIC of 2 µg/mL for an $AUC_{total, 0\text{-}24h}$/MIC target attainment of 4.5 may be appropriate.

Conclusions: Resistant gram-negative bacteria infections that are associated with a tigecycline MIC ≥ 0.48 µg/mL may require treatment with alternate antibiotics, based on the failure to attain PK-PD tigecycline targets.

Implementation and Suspension of an Antimicrobial Stewardship Audit and Feedback Program: Impact on Antimicrobial Utilization Patterns in an Inpatient General Internal Medicine Unit

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Background: A goal of Antimicrobial Stewardship Programs (ASPs) is to optimize antimicrobial use; many ASPs use the audit and feedback (AAF) approach. Although AAF decreases unnecessary antimicrobial use, it is resource-intensive and may be difficult to sustain. There are limited data describing the long-term effects on antimicrobial use during suspensions in an ASP's AAF program.

Description: This retrospective study describes the implementation and subsequent temporary suspensions of AAF in the General Internal Medicine (GIM) unit at an urban teaching hospital. Data was collected over 65 months; during "active-AAF" time-frames, a dedicated, ID-trained clinical pharmacist and ID physician reviewed targeted antimicrobials from all GIM patients and made recommendations.

Action: GIM antimicrobial utilization was described by Defined Daily Doses (DDD) and costs ($CAD), normalized per 1000 patient days. Data were compared two ways to assess immediate and long-term impacts of AAF activities (implementation and 2 temporarily suspensions): 1. All "active-AAF" time-frames were compared with "non-active AAF" (including pre-ASP), 2. Pre-ASP was compared with post-ASP).

Evaluation: Results are presented in Table 1. Comparing all "active-AAF" to all "non-active AAF" months, significant decreases (P<0.05) in DDD were observed for targeted antimicrobials: antipseudomonal antibacterials (-29%) and fluoroquinolones (-56%). A non-significant decrease (-6%) was observed for overall antimicrobial DDDs. Comparing DDD utilization for during and Post ASP AF, post ASP led to an increase in the average utilization.

Implications: Our results show that temporary suspension of ASP AAF impacts antimicrobial utilization trends. Sustained decreases in targeted antimicrobials utilization were associated with active AAF. However, overall decreases in antimicrobial utilization were observed after initial implementation of ASP AAF (regardless of temporary suspension).

For the table that goes with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

Assessment of a Therapeutic Drug Monitoring Strategy of Once Daily Dosing of Gentamicin/ Tobramycin in Paediatric Patients

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Background: Lack of evidence to support the use of once daily dosing (ODD) of aminoglycosides in paediatric patients. In July 2014, ODD was implemented for all eligible paediatric patients in a tertiary hospital.

Objectives: To evaluate the ability of a once daily intravenous (IV) dose of 9 mg/kg gentamicin or tobramycin to achieve a target maximal concentration (C_{max}) of 16-25 mg/L, refine optimal sampling times, assess efficacy and safety in paediatric patients and compliance to the hospital's therapeutic drug monitoring (TDM) guideline.

Methods: Pharmacokinetic parameters were calculated from serum gentamicin or tobramycin levels drawn 3 and 6 hours after the aminoglycoside infusion and summarized using descriptive statistics. Monte-Carlo simulations based on calculated pharmacokinetic parameters were used to assess optimal dosing regimens.

Results: One hundred and forty children with 149 aminoglycoside courses were included. Mean pharmacokinetic parameters were: volume of distribution of 0.46±0.22 L/kg, clearance of 0.17±0.07 L/h/kg and half-life of 1.88±0.46 h. Approximately half of the courses achieved C_{max} target with the initial dose. Monte-Carlo simulations showed highest C_{max} target attainment with 9 mg/kg/dose IV once daily. Approximately half of the empiric courses that did not reach C_{max} target stepped down to oral antibiotics. Majority (77%) of patients defervesced at the end of the course. No nephrotoxicity was identified. Almost all courses (99%) used an initial dosing of 9 mg/kg as per formulary guideline. Approximately 66% of all courses screened had levels drawn only if patient received 3 or more doses of aminoglycosides. Only 34% of post-operative surgical patients had their levels drawn on or after post-operative day 2.

Conclusion: An initial aminoglycoside dose of 9 mg/kg/dose IV once daily is appropriate in achieving a C_{max} of 16-25 mg/L and appears to be efficacious and safe in paediatric patients. Majority of courses complied with the TDM guideline.

A Drug Use Evaluation of Aerosolized Ribavirin at a Canadian Teaching Hospital

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Background: Respiratory syncytial virus (RSV) causes life-threatening infections in immunocompromised hosts, leading to excess morbidity and mortality. Ribavirin is a guanosine analogue that is active against multiple viruses including RSV and is the cornerstone of treatment of RSV infections. Little is known about the patient characteristics that are most commonly treated with ribavirin at our institution.

Objective(s): The purpose of this investigation is to characterize the use of aerosolized ribavirin at our institution and report the clinical outcomes associated with its use.

Methods: Pharmacy records were accessed to identify the 61 patients for whom aerosolized ribavirin was dispensed from September 1st 2016 to September 1st 2018; 62 treatment courses were identified as one patient was treated twice. A retrospective chart review was conducted to obtain patient demographic and clinical data associated with aerosolized ribavirin treatment.

Results: The majority of patients who were treated with aerosolized ribavirin were immunosuppressed patients and lung transplant recipients. The primary indication for ribavirin was an RSV infection (98.4%) and for those where follow-up polymerase chain reaction (PCR) results were available, 84.6% converted to a negative PCR result at 30 days.

Conclusion(s): Our results indicate that the most commonly treated patients were those who were immunosuppressed and/or lung transplant recipients. Aerosolized ribavirin was associated with a high 30-day PCR conversion rate (84.6%), a low all-cause 30-day mortality (1.6%) and a low incidence of adverse effects (6.5%), where dyspnea was the most common.

For the tables that go with this abstract, please see Abstract Appendix, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/188/showToc

Hypoglycemia in Paediatric Cardiology Patients Initiated on Propranolol: A Retrospective Review

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Background: Propranolol is commonly prescribed in paediatric cardiology patients for arrhythmia, hypertension and TET spells. Paediatric patients, especially neonates, have an increased risk of hypoglycemia due to impaired and immature blood glucose regulation. Untreated hypoglycemia can lead to seizures, permanent brain injury, and potentially death. Propranolol has been shown to cause hypoglycemia but the extent and risk in paediatric patients with heart disease is unclear.

Objective(s): To describe the incidence of hypoglycemia and explore potential factors for development of hypoglycemia in paediatric and neonatal cardiology patients initiated on propranolol.

Methods: Retrospective chart review of cardiology patients aged less than 6 months, newly initiated on propranolol from September 14th, 2016 to September 23rd, 2017. Serum glucose, propranolol dosing, and risk factors for hypoglycemia (based on age-specific serum glucose ranges) were collected and analyzed by descriptive statistics. Univariate association between potential risk factors and hypoglycemia was assessed using chi-square analyses.

Results: Fifty patients on propranolol mostly for arrhythmias, TET spells, or hypertension with a mean starting dose of 0.87±0.27mg/kg/dose (range 0.13-1.14mg/kg/dose). Five of 50 patients (10%) developed hypoglycemia after propranolol initiation. Hypoglycemia onset was between 6h22min and 38h53min of propranolol initiation, where treatment ranged from none (self-resolved) to treated with dextrose/sucrose/glucose. Most patients with baseline high serum glucose remained high or normal after propranolol initiation (89%). One of 3 patients with baseline low serum glucose continued to display hypoglycemia after propranolol initiation. Eight patients were missing baseline serum glucose levels. There was no association between risk factors (sex, prematurity, age, indication, liver function, thyroid function) and hypoglycemia (α=0.05).

Conclusion(s): Hypoglycemia developed in ~ 10% of paediatric cardiology patients initiated on propranolol in current retrospective study, without significant association between risk factors and hypoglycemia. There is a need for standardized glucose monitoring and future study of a larger cohort for this population.

Anticholinergic Potential Risk Assessment Scales: Comparison of Drugs and Risk Scores

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Background: Drugs with anticholinergic potential worsen cognition in older adults. Published anticholinergic drug scales help clinicians determine the severity of anticholinergic impact of certain drugs. However, the severity of anticholinergic potential for many drugs is rated inconsistently between the different scales. Furthermore, many of the drugs listed are often unavailable in Canada, decreasing the clinical utility of the scales.

Objectives: The goal of this project was to identify anticholinergic risk potential scales and compare the severity of anticholinergic potential rating between the different scales for the same drugs.

Methods: We conducted a literature search to identify scales that examine and assign an anticholinergic risk score to drugs. From each study, we extracted the methodology for developing the scale and their validation studies, if available, for comparison. We extracted and consolidated anticholinergic potential risk scores for all drugs, and stratified drugs based on the level of score concordance.

Results: We identified 9 scales in the literature search from which we retrieved 236 drugs with anticholinergic risk scores that are available in Canada. Most scales used a 4-point integer scale of 0-3 to rate anticholinergic risk, although there was significant variation in methodology used to assign the scores. The definition of "anticholinergic effect" was also different for each scale. Thirty-two (32) drugs were consistently identified as high anticholinergic risk across the scales, 18 as intermediate, and 18 as low risk. Anticholinergic risk of an additional 168 drugs could not be determined due to inconsistent scores or insufficient data.

Conclusions: Of the 236 drugs assessed for anticholinergic risk, the ratings were consistent for only 68 drugs between the different scales. Moving forward, we intend to establish a consensus on the anticholinergic severity of the 168 inconsistently rated drugs that are commonly used in Canada.

Photosensitivity Associated with Long-Term Voriconazole Therapy: A Case Report

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Background: Adverse dermatologic reactions to voriconazole include fixed drug eruptions, cheilitis, discoid lupus erythematosus and Stevens-Johnson syndrome. In particular, less than 2% of patients develop photosensitivity reactions, presenting on sun-exposed areas of the body.

Case Description: A 5-year old female diagnosed with acute lymphoblastic leukemia currently undergoing maintenance therapy developed a maculopapular erythematous rash on the scalp and face with excoriations. At the time, she was receiving trimethoprim-sulfamethoxazole (TMP/SMX), methotrexate, 6-mercaptopurine and voriconazole, all of which are known to be photosensitizing drugs. Voriconazole therapy was initiated for a suspected *Aspergillus* infection.

Assessment of Causality: Corticosteroids were initially prescribed for the affected areas, with minimal relief. A pediatric dermatologist suggested the rash was a photosensitivity reaction. The TMP/SMX was stopped and the rash persisted for several months thereafter. Voriconazole had been initiated approximately 12 months prior to the onset of the rash. The drug was stopped and the patient's caregiver reported that within 3 days the rash had cleared. The Naranjo scale was used to assess causality for the adverse reaction. A score of 7 identified voriconazole as a probable cause of the rash.

Literature Review: A case report previously identified 20 children who experienced photosensitivity reactions, with the majority having an underlying immunodeficiency. The onset of the reaction ranged from 2 weeks to 4.5 years on therapy. A retrospective analysis identified 5 patients with chronic graft-versus-host disease voriconazole-induced sensitivity mimicking a cutaneous flare.

Importance to Practitioners: Voriconazole-induced photosensitivity reactions are uncommon. Prompt recognition and drug discontinuation often facilitate improvement. Practitioners should screen for the potential concomitant use of photosensitizing drugs, and advise patients to avoid prolonged sun exposure, and the need for sunscreen.

Safety of Enteral Nutrition Interruption around Levothyroxine Doses in Critically Ill Patients

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Background: Levothyroxine is recommended to be administered orally in a fasting state but few studies have examined the impact of enteral nutrition (EN) on absorption. However, ample evidence exists to demonstrate the importance of adequate feeding in critically ill patients. Practice at one hospital has historically varied between campuses, with nurses in one intensive care unit (ICU) generally holding EN two hours pre- and post- levothyroxine doses and nurses in the other ICU not interrupting EN.

Objective: Assessing our current state can help support the development of a consistent practice within the institution.

Methods: A retrospective chart review examined the safety implications of EN interruption around levothyroxine doses in critically ill patients. Eligible patients included adults admitted on levothyroxine to either ICU (N=30 per group). The primary outcome was the difference in the percentage of target daily EN volume received. Secondary outcomes included safety parameters (ventilator-free days, mortality, length of ICU stay and episodes of hypoglycemia potentially related to EN interruption). Descriptive statistics were calculated.

Results: Variability in practice exists both between and within sites. EN was held for a minimum of one hour pre- and post-dose for 87.3% of levothyroxine doses in one ICU compared to 0% of doses in the other ($p<0.001$). There was no EN rate adjustment in 20% of the cases where EN was held. The primary outcome of the average percentage of target daily EN intake received over the ICU stay was not significantly different between the two study groups (85% vs. 83%, $p = 0.804$). There were no statistically significant differences between the groups with respect to all secondary safety outcomes.

Conclusion: This study suggests that the inconsistent practices around the levothyroxine-EN interaction do not lead to differences in nutritional intake and a number of important safety outcomes.

Étude rétrospective des accidents et incidents associés à la documentation des doses de médicament dans un hôpital universitaire

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Contexte : Une erreur médicamenteuse peut se produire à n'importe quelle étape du circuit du médicament et conduire à un incident (I) ou un accident (A). Bien documenter les doses administrées grâce à la feuille d'administration des médicaments (FADM) dans le dossier patient est primordial

Objectif(s) : Décrire 14 ans d'I/A médicamenteux en lien avec la documentation des doses de médicaments.

Méthodologie : Il s'agit d'une étude descriptive rétrospective. Tous les rapports d'I/A médicamenteux extraits à partir de Gesrisk entre le 1er avril 2004 au 31 mars 2018 ont été recueillis. Les I/A médicamenteux associés à la documentation des doses de médicaments ont été inclus lorsque les mots clés suivants ont été identifiés dans les données: «FADM», «profil», et la combinaison des mots «feuille» + «médicament». Un échantillon aléatoire de 50 rapports a été analysé de façon approfondie.

Résultats : Un total de 25705 rapports I/A médicamenteux ont été identifiés dont 25,7% (6599) était associé à la documentation des doses. En 14 ans, cette proportion a doublé (16,2% (263/1620) en 2004; 34,9% (524/1503) en 2018). Ces I/A liés à la FADM sont principalement dû à l'omission d'administration d'une dose (2242/6599, 34,0%), un mauvais horaire d'administration (1148/6599, 17,4%) et l'interception de l'erreur avant administration (947/6599, 14,4%). Plus de la moitié des I/A liés à la documentation des doses sont de gravité C (4416/6599, 66,9%). La mauvaise lecture de la FADM représente 49% (23/47) des I/A audités.

Conclusion(s) : Vingt-six pourcent des I/A sont associés à la documentation des doses et cette proportion a augmenté au fil du temps. Cette hausse est possiblement associée à l'émergence d'outils électroniques qui permettent d'identifier plus facilement les divergences ainsi qu'à la mise en place de protocoles de soins de plus en plus complexes.

Rapid Onset of Cholelithiasis in an Adult Treated with Ceftriaxone

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Background: Ceftriaxone is a third-generation cephalosporin with broad-spectrum antibacterial activity. Here, we report a case of ceftriaxone-induced cholelithiasis in an adult patient after a short period of administering ceftriaxone.

Case Description: A 57-year-old female was admitted to our hospital for meningitis and treated empirically with ceftriaxone 2 g every 12 hours. Other medications given included vancomycin, ampicillin and acyclovir. Based on culture results and a sensitivity report, ceftriaxone was continued while other medications were discontinued on day three after admission. Her liver function test (LFT) demonstrated an elevation in hepatic transaminases, and alanine and aspartate transaminases peaked on the fifth day (339 and 153 IU/L, respectively). Computed tomography (CT) and ultrasound (US) confirmed the presence of uncomplicated cholelithiasis. Ceftriaxone was discontinued and switched to cefotaxime 2 g every four hours. Hepatic transaminases started declining after ceftriaxone discontinuation and dropped to normal levels on day nine. After the administration of cefotaxime on the 25th day, repeated US imaging revealed the persistence of biliary sludge. The patient was discharged in a good and stable clinical condition with follow-up planned at the outpatient clinic.

Assessment of Causality: When the concentration of ceftriaxone in the gallbladder exceeds the solubility of its calcium salt, precipitation occurs, forming a biliary sludge. Using the Naranjo Probability scale, the score was found to be 4, indicating a possible relationship between ceftriaxone and cholelithiasis.

Literature Review: Multiple case reports of ceftriaxone-induced cholelithiasis have been documented previously, most of which focused on children or on the prolonged use of ceftriaxone. However, our case report highlights the development of cholelithiasis in adults after administering ceftriaxone for a short time.

Importance to Practitioners: It is essential to monitor cholelithiasis and hepatic transaminase levels in both adult and pediatric patients receiving high doses of ceftriaxone.

Evaluation of the Use of 'Do Not Use Abbreviations' in Hospital Orders: A Quality Assurance Audit

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Background: To determine the use of 'Do Not Use Abbreviations' (DNUA) in written medication orders in Horizon hospitals and compare results from 2017.

Description: Over a five-week period, audits were conducted across 12 hospitals on five different days of the week. All medication orders sent to pharmacy containing medication orders were reviewed and screened against the Institute for Safe Medication Practices (ISMP) list of Dangerous Abbreviations. Data collected from the 12 sites was analyzed and information about the audit results was then disseminated to staff.

Action: The audit was initially completed in August 2017 and repeated in 2018, to compare results and to detail improvement or lack thereof. Baseline results from 2017 were shared with prescribers, nursing and senior leadership. No further education was initiated.

Evaluation: In total, 15781 orders were received over the five-day audit period in 2018. Of these, 2360 (15%) of orders contained an abbreviation on the list of DNUA. There was a 2% increase overall of the use of dangerous abbreviations. The most used DNUA were 'OD', 'D/C', and '@', with the most DNUA being seen in Fredericton, Moncton and Upper River Valley. The percentage of orders written by physicians remained the same over both years at 76%, with nursing writing 16% of orders which decreased 1% from last year.

Implications: The use of DNUA in hospitals in New Brunswick seems to be increasing and therefore putting patients at increased risk of medication errors. A system to decrease the use of these abbreviations needs to be implemented and taken seriously by the involved parties to help ensure better patient safety in the province.

Leveraging the Electronic Health Record for Medication Safety Indicators

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Background: In 2017, the institution implemented a fully electronic health record system. Medication safety indicators were chosen for both the Pharmacy and corporate level. These were primarily chosen to align with the Solutions for Patient Safety Adverse Drug Event Prevention roadmap.

Description: The Medication Safety Committee is comprised of representation from Pharmacy, Director of Nursing Practice, Medical Director of Patient Safety, Nursing Directors, Quality and Risk Management and Information Services. The committee selected the primary indicators to be monitored. The patient care leadership teams present on a regular basis their unit specific indicators and action plan.

Action: The hospital created practice standards for each indicator. In collaboration with the electronic health record reporting team, reports were developed to support monitoring and analysis of the indicators.

Evaluation: The Pharmacy medication safety indicators for September are: (1) medication cabinet restock scanning compliance – 96%; (2) medication order validation turnaround time – 14 minutes for regular priority and 5 minutes for high priority orders; (3) dispense preparation barcode scanning compliance – 98%; (4) medication reconciliation on admission within 48 hours – 85%. The corporate indicators are: (5) smart pump drug library compliance – 83 to 93%; (6) barcode medication administration (BCMA) scanning compliance – 93%; (7) allergy documentation prior to prescribing medications – 75%; (8) medication incidents that reach the patient – 21 events.

Implications: Consistent monitoring of medication safety indicators increases medication safety awareness and contributes to the achievement of reproducible positive results and the maintenance of highly reliable patient care.

Implementation of Barcode Medication Administration Using a Quality Improvement Approach

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Background: In 2016, Barcode Medication Administration (BCMA) was added to the scope of our hospital's electronic health record (EHR) go-live planning. BCMA improves patient safety by decreasing medication administration errors.

Description: The goal was to reach 94% compliance for scanning both the medication and the patient.

Action: A team was formed jointly with Nursing and Pharmacy and a nurse was dedicated to the BCMA project for one year. A quality improvement approach was used to analyze and adjust workflows, EHR functions, devices, and physical space. Medication administration processes were identified using observation and group discussions. An FMEA was conducted for each proposed process. Using a human factors approach, we re-designed the unit medication rooms to fit additional workstations without compromising nursing workflow. We performed a 5S concurrently. A 5S is a method of organizing a work space for efficiency and effectiveness. Simulations of medication administration workflows were done with nurses and respiratory therapists to evaluate the mobile devices, which significantly influenced decision-making.

Evaluation: Initial BCMA rates, defined as scanning both the medication and patient, were 78%. This increased as we made continuous improvements. The greatest improvement came several months when ownership of this safety initiative clearly transferred to clinical leadership of each unit. Scanning rates are now at 92.6% for scanning both patient and medication, 94% for scanning medication only, and 95% for scanning patient armband only. We also track scanning rates by unit, medication, and staff member. BCMA catches, on average, 70 near-miss safety events every day.

Implications: Scanning both medication and patient during barcode medication administration represents best practice in administration of medication in hospital. Our quality improvement approach involving extensive collaboration with nursing, FMEA, human factors analysis, and simulations of medication administration was key in the success of the project.

Factors Influencing Prescribing of Direct Oral Anticoagulants in the Elderly Leading to Adverse Outcomes: An Analysis from the Windsor Region

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Background: Prescribing direct oral anticoagulants (DOACs) in elderly patients can be challenging due to their increased risk of renal insufficiency, polypharmacy and multiple comorbidities.

Objective: The primary objective of our study was to analyze patterns associated with prescribing of apixaban, rivaroxaban, and dabigatran in elderly patients admitted to our hospital with a bleeding-related adverse event.

Methods: A retrospective chart review was performed for patients 80 years or older admitted with a gastrointestinal, or intracranial hemorrhage (ICH) between April 1, 2015 and October 31, 2017. The best possible medication history confirmed patients were on a DOAC at admission. DOAC dose was assessed relative to product monograph recommendations. Descriptive and inferential statistics were used to analyze prescribing trends. A logistic regression analysis was performed to evaluate risk factors for being prescribed an inappropriate DOAC dose including gender, weight, creatinine clearance, HASBLED score, and concomitant antiplatelets, NSAIDs, or P-gp/3A4 interacting drugs.

Results: A total of 117 patients admitted with a gastrointestinal bleed or ICH were on a DOAC prior to admission. The majority of patients had atrial fibrillation and were prescribed rivaroxaban ($p<0.001$). Forty-three percent of patients were prescribed an inappropriate DOAC dose, of which apixaban was significantly prescribed at lower doses ($p=0.02$) and rivaroxaban at higher doses ($p<0.001$). Elderly patients with a creatinine clearance of 15-30 mL/min were more likely to be prescribed inappropriate DOAC doses (OR: 5.57[95% CI, 1.9-17.57]). Despite being prescribed the monograph-recommended dose, 57% of patients still experienced a bleeding event.

Conclusion: Elderly patients, especially those with severe renal impairment, are at risk of being prescribed an inappropriate DOAC dose. Most patients are under dosed on apixaban and overdosed on rivaroxaban. Our study suggests that the appropriateness of DOAC dose may not be the only factor contributing to adverse bleeding events.

Medication Reconciliation at Hospital Admission: Proactive versus Retroactive Models

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Background: The medication reconciliation (MedRec) process conducted at hospital admission uses either a proactive or retroactive model. Many hospitals have experienced challenges with MedRec, particularly its proactive model. Studies comparing the models are scarce.

Objective: The aim of this study was to analyze and quantify the retroactive and proactive MedRec models.

Methods: This prospective, observational study was conducted at Regional Hospital from May to June 2018. All of the patients undergoing MedRec during this time were included, except those who were discharged from the hospital, transferred to another hospital, or died within 48 hours of admission. The primary end point was to compare the time components of the process for the two models. The secondary end point was to determine the types of intentional and unintentional medication discrepancies identified and the frequency with which they occurred.

Results: After 249 MedRecs had been reviewed, 180 patients were enrolled. The total number of medications reconciled was 2118. Of the 180 patients, 84 (46%) were evaluated with the proactive model. There was no significant difference in the number of comorbidities identified ($p = 0.282$) or medications reconciled ($p = 0.093$) per patient for the two models. The median time from admission to the MedRec process was significantly shorter for the proactive model (48 minutes) than the retroactive model (1135 minutes) ($p < 0.001$). The percentage of documented intentional medication modifications in the proactive model (16.3%) was more than twice that in the retroactive model (7.3%) ($p < 0.001$). Patients evaluated by the proactive model had a significantly shorter hospital stay than those evaluated by the retroactive model ($p < 0.001$).

Conclusion: This study demonstrated that implementation of the proactive model was feasible. Compared with the retroactive model, the proactive model had a positive impact on preventing discrepancies with timeliness and efficiency.

Assessing Medication Reconciliation in Hospitalized Adult Patients Discharged from Accountable Care Units in Saskatchewan Health Authority - Regina

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Background: Hospital discharge is a critical transition point for patients and may result in unintentional medication changes that increase potential or actual drug related problems, emergency department visits, readmissions, and preventable patient harm.

Objectives: To compare patients discharged from an Accountable Care Unit (ACU) using a standard versus non-standard discharge process on rates of overall unjustified medication discrepancies, Institute for Safe Medication Practices (ISMP) high risk medication discrepancies, involvement of the clinical pharmacist, and to identify potential causes of discrepancies.

Methods: Patients 18 years of age and older discharged during clinical pharmacist hours from one of two ACUs, one with (Unit A) and one without (Unit B) a standard discharge process, between October 10, 2017 and January 22, 2018.

Results: From our sample of 100 patients, 245 unjustified medication discrepancies were identified in 61 patients. Half of the patients from Unit A were discharged with at least one unjustified medication discrepancy versus 72% (36/50) from Unit B. The proportion ISMP high risk medication discrepancies were lower on Unit A than Unit B (7/49 vs. 35/196). Pharmacist documentation on Unit A was half that of Unit B (4/50 vs. 8/50). The majority of unjustified medication discrepancies were omissions from Unit B (190/245). Unit A had a lower proportion of patients discharged with 5 or more unintentional medication discrepancies compared to Unit B (4/50 vs. 16/50).

Conclusions: More than half of patients were discharged from an ACU with at least one unjustified medication discrepancy. A standard discharge process decreased the proportion of unjustified discrepancies at discharge, including those involving ISMP high risk medications. Interpretation of clinical pharmacist impact was limited due a small proportion of documented pharmacist involvement. A standard process for medication reconciliation with improvement in documentation of rationale for medication may decrease the rate and impact of medication discrepancies.

The Utilization of Splenectomy Post-Op Clinical Vaccinations Order Sets to Enhance Adherence and Timeliness of Vaccinations in Splenectomy Patients: A Pre-and-Post Intervention Study

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Background: Asplenic patients are at increased risk of serious and life-threatening infections, especially by encapsulated pathogens. Over-whelming Post Splenectomy Infections (OPSI) are associated with an elevated mortality rate, however it can be easily prevented with appropriate vaccination prior to or post-splenectomy. Majority of asplenic patients (60%+) have limited or no knowledge of their infection risk. The Splenectomy Post-Op Clinical Vaccinations Order Sets is one of the first initiatives to harmonized practice between sites at our organization and proved to be a success.

Objectives: This is a pre and post-intervention study aimed to assess the impact of the Splenectomy Post-Op Clinical Vaccinations Order Sets to improve practice adherence to recommended vaccination protocols outlined by the Canadian Immunization Guidelines among patients undergoing splenectomy.

Methods: A 5-year retrospective chart review was conducted in 2013 for the pre-intervention quantitative data. Another 5-year retrospective chart review was conducted in 2018 to determine post-intervention rates. The quantitative results were then tallied and analyzed.

Results: Prior to the implementation of the Splenectomy Post-Op Clinical Vaccinations Order Sets, 61% of patients at the organization received the required vaccinations. Post-intervention, vaccination rates increased to 93%. Vaccinations were given on average, 10 days post-op, and most were given prior to hospital discharge. Qualitative analysis of order set showed excellent physician adoption rates within the hospital. Also, the initiative improved patient care by enhancing communication with primary care physicians via the structured discharge instructions included within the order set.

Conclusion: Vaccinations rates increased by 32% post-implementation of the Splenectomy Post-Op Clinical Vaccinations Order Sets, illustrating that a structured approach is necessary to improve clinical practice, enhance care and decrease potential life-threatening infections.

Utilization of Health Literacy Assessment Tools to Tailor Patient Counselling

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Background: Patients with low health literacy experience difficulty in understanding their medications leading to overall poorer health outcomes. Pharmacists can utilize different strategies to better tailor their patient education for these individuals. However, in order to utilize these strategies, they need to be able to effectively identify these patients. Without the use of formal assessment tools, health care practitioner's identification of patients with low health literacy is poor. It is unclear whether pharmacists currently utilize health literacy screening tools or if they incorporate different counselling strategies in this patient population.

Objectives: To characterize pharmacists understanding of health literacy and their use of screening and counselling strategies before and after completion of an educational module. To identify barriers that pharmacists perceive to exist that prevents them from using health literacy tools.

Methods: Pharmacists in three health authorities were administered a pre-survey and then given access to an online 10-minute educational video. The post-survey was sent 1-month later. Descriptive statistics were used to quantify survey responses with comparisons made between pre and post responses.

Results: There were 131 respondents for the pre-survey and 39 for the post-survey. In the pre-module survey, 83% of pharmacists felt they understood what health literacy was but only 52% currently assessed patients for their health literacy status and 40% were aware of what strategies to use in low health literacy patients. Lack of time (74%) was the biggest barrier in assessing patients' health literacy. In the post-module survey, 87% felt they understood what health literacy was and 64% incorporated health literacy status evaluation into their clinical practice. The educational module was helpful to the clinical practice of 74% of respondents.

Conclusion: A short educational intervention can improve pharmacists' understanding of health literacy. Time remains the biggest barrier in improving care of these patients.

Development of an Inpatient Pharmacist Diabetes Educator Role

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Background: Consistent with Canadian Diabetes Association Clinical Practice Guidelines' recommendations, inpatient diabetes education is essential for patients newly diagnosed with diabetes to self-manage insulin injections in the community.

Description: A pharmacist inpatient diabetes educator role was developed, implemented, and reviewed.

Action: A previous evaluation indicated a need for patient- and systems-level approaches to inpatient diabetes education (e.g. patient consultations, staff education, systems enhancements). A pharmacist was considered ideal to fulfill this new role due to his diabetes drug knowledge. A pharmacist-led inpatient diabetes consultation service was implemented to provide diabetes education (e.g. new diagnosis, insulin starts/changes, meter teaching, diabetic ketoacidosis management), assist in blood glucose management, and help facilitate discharge. Staff education was provided (e.g. hypoglycemia management, insulin pen usage, insulin formulary recommendations) along with systems enhancements (e.g. insulin pen rollout, hypoglycemia protocol, insulin order set revisions).

Evaluation: Review of the role after 9 months indicated the following: 142 patient consultations were completed; consults averaged 4 per week (range 1 to 9); average consult time 90 to 120 minutes (range 30 to 240 minutes); most consults required 1 visit to complete (range 1 to 5 visits); 49% of consults were for new insulin starts followed by complex diabetes management (23%), glucometer teaching (11%), diabetic ketoacidosis management recommendations (7%), insulin pump management (4%); 56% of consultations were seen the same day. Only 8 patients seen for consultation were readmitted for diabetes related issues (e.g. insulin non-adherence). Regarding systems-level approaches, the diabetes pharmacist led: 11 inpatient staff education sessions; conversion of the institution to insulin pen administration; implementation of 5 new insulin order sets; and removal of all insulin sliding scales from institutional prescribing system.

Implications: The new inpatient diabetes pharmacist role added to the institution's quality dimensions by providing timely diabetes education, provided staff education, and implemented several key diabetes initiatives.

Analyse descriptive des publications dans le domaine de la pharmacie de 1973 à 2016

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Contexte : La publication scientifique permet de commenter l'évolution d'une discipline.

Objectif(s) : Décrire et commenter la publication scientifique dans le domaine de la pharmacie et son évolution dans le temps.

Méthodologie : Étude descriptive rétrospective. Extraction réalisée à partir de l'index de citations Web of Science (WOS) à partir des critères: discipline (Clinical medicine) et spécialité (pharmacy). Analyses réalisées à l'aide d'un chiffrier (Excel[MD]) en fonction de l'année publication, de la revue, du pays de l'auteur correspondant, du pays et de la langue de la revue.

Résultats : Un total de 103538 articles ont été publiés, dans 40 revues, de 1973 à 2016 dans la spécialité « pharmacy », représentant 1,09% de la discipline « clinical medicine ». Cette proportion diminue dans le temps (2.43% en 1973 vs 0.72% en 2016). Le top-5 des auteurs correspondants depuis 1977 (n=80145) proviennent du Japon (23%), États-Unis d'Amérique (21%), Allemagne (9%), Chine (6%) et Italie (5%). Le Canada est au 15ème rang (1%). Le top-5 des journaux ayant le plus de publications sont: Chem. Pharm. Bull (20%), Int. J. Pharm (15%), Pharmazie (11%), Eur. J. Med. Chem. (9%) et Yakugaku Zasshi (7%). Le seul journal canadien représenté est le Can J Pharm Sc (n=280 articles, <1%). Parmi les revues utilisées par les pharmaciens hospitaliers, on retrouve Am J HealthSys Pharm (6,9%), Drug Saf (2%), DICP (2%), PWS (1%). Les publications sont principalement en anglais (93%), en allemand (6%) et dans d'autres langues (1%). Certaines revues populaires en pharmacie ne sont pas recensées dans l'étude car elles ne comportent pas le terme « pharmacy » dans leurs mots-clés.

Conclusion(s) : La proportion des articles codés « Pharmacy» est en diminution depuis 1973. Le Canada représente une part marginale de ces publications dans WOS.

Face and Content Validation of an Instrument to Measure Medication Management Capacity in Older Adults

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Background: Numerous medication adherence products are marketed to improve medication adherence. However, no tools currently address the evaluation of domain-specific limitations among older adults managing medications.

Objectives: The objective was to investigate face and content validation of the Domain Specific Limitation in Medication Management Capacity Instrument, a tool developed to measure domain-related problems among older adults self-managing medications. Domains and sub-domains in this instrument were 1. physical abilities (vision, dexterity, hearing); 2. cognition (comprehension, memory, executive functioning); 3. medication regimen complexity (dosing regimen, non-oral administration, polypharmacy); and 4. access/caregiver (prescription refill, new prescription, caregiver).

Methods: Healthcare professionals, recruited through purposive sampling, assessed each variable within domain and sub-domains for relevance, importance, readability, understandability, and representation. Percent agreement and content validity index (CVI) for each variable was determined to examine face and content validity.

Results: Twelve pharmacists participated in the study, of whom 83% were female with a mean of 12.4 years of practice. Domain-specific percent agreement for relevance were Physical Abilities 98%, Cognition 100%, Medication Regimen Complexity 90%, and Access/Caregiver 92%. Domain-specific percent agreement for importance were Physical Abilities 98%, Cognition 100%, Medication Regimen Complexity 88%, and Access/Caregiver 90%. All domain relevance and importance CVI scores were 100%. Sub-domain percent agreement scores were above 80% except for relevance of hearing (73%), and importance for hearing (66%), and new prescription (75%). Similarly, sub-domain CVI scores were above 80% except for importance of new prescription (73%). Eighty-three percent (35/42) of variables maintained relevance and 79% (33/42) maintained importance CVI scores above 80%. Fifteen variables were either removed (8) or modified (7) due to low CVI scores for at least one measurement (relevance, importance, readability or understandability).

Conclusions: This tool can be used to assess and identify domain and sub-domain specific limitations in medication management capacity among older adults.

Improving Pharmacist-Pharmacist Communication at Hospital Discharge

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Background: Patients are particularly vulnerable during transitions in care, often due to miscommunication between health care providers. PROMPT, an intervention focused on improving communication between hospital and community pharmacists, facilitates medication management at the time of hospital discharge.

Objective: To assess the fidelity, the degree to which the intervention was delivered as intended, and community pharmacist perceptions of PROMPT.

Methods: Descriptive feasibility study (Jan – Apr 2018). Setting: General Internal Medicine units. Patient eligibility criteria: adults ≥ 18 yrs, admitted to a general internal medicine unit for ≥ 72 hours, taking ≥ 5 medications when discharged home. Intervention: Hospital pharmacists fax a patient's usual community pharmacy their discharge prescriptions and medical discharge summary (when available) with their contact information and follow-up by telephone. Data Collection: Process tracking forms (fidelity), Phone surveys (community pharmacists' perceptions about the intervention).

Results: Forty-five patients received the intervention provided by 12 hospital pharmacists across two hospitals. Forty-two phone surveys were completed with 37 unique pharmacies. Intervention fidelity was suboptimal: 78% (35/45) of interventions did not include discharge summaries, 24% (11/45) of discharge packages did not include contact information, and 3 process tracking forms were excluded because the discharge prescriptions were provided to patients directly. On a 9-point Likert-type scale, community pharmacists believed all components of the intervention were extremely important, including the contact information (median 9, IQR: 0), the discharge summary (median: 9, IQR: 1), and the follow-up phone call (median: 9, IQR: 2).

Conclusion: The high ratings of the importance of PROMPT suggest that community pharmacists view the program favorably. To improve fidelity, recommendations include broadening eligibility criteria to increase enrollment and providing iterative feedback to hospital pharmacists during data collection. Areas for future research include interviews with hospital and community pharmacists to gain in-depth feedback about PROMPT and assessing fidelity at additional sites.

Exploring the Perspectives of Healthcare Professionals in Delivering Optimal Oncology Medication Education

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Background: Patient education is an important component of chemotherapy treatment as it has been shown to positively impact patients who receive it. This education is often provided by multidisciplinary teams with the goal of improving patient care. However, informational discrepancies exist in what healthcare professionals prioritize compared to the patients they treat. Generally, each healthcare professional has their own approach and chooses the amount of information provided to patients. To optimize patient education, it is important to understand what healthcare professionals perceive to be ideal oncology medication education for patients to receive and what they feel is their role and the role of others in its delivery. Few studies have explored the roles of healthcare professionals in delivering oncology medication education and it is unknown what healthcare professionals at Nova Scotia Health Authority - Central Zone (NSHA) perceive as their role in this.

Objective: To explore the perspectives of healthcare professionals working in medical, gynaecological or hematological oncology to identify what they perceive to be optimal oncology medication education for patients.

Methods: Healthcare professionals (physicians, nurses and pharmacists) working in medical, hematological or gynaecological oncology at NSHA were invited to participate in one-on-one semi-structured interviews which were audio-recorded, transcribed and analyzed using thematic analysis.

Results: Fifteen interviews, including five physicians, four nurses and six pharmacists were conducted from February to April 2018. Four major themes were identified; *Delivery of oncology medication education, Facilitating the patient learning process, Multidisciplinary approach and Understanding barriers to the healthcare professional in providing education.*

Conclusion: Identified themes uncovered some previously unknown ideas about how healthcare professionals felt education could ideally be delivered to patients and also supported some of the findings in the literature. The data obtained will inform the design of any new models for oncology medication education at this site and potentially others.

Development and Implementation of a Competency Assessment Tool for Hospital Pharmacists

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Background: One of pharmacists' greatest contributions to patient care is pharmacotherapeutic knowledge and skills, regardless of setting. The "Oath of a Pharmacist" states, "I will accept the lifelong obligation to improve my professional knowledge and competence". At present, no Canadian hospital pharmacy specific competency assessments are published. We set out to develop a tool in our institution to ensure ongoing competency assessment and aid in staff development.

Description: Departmental competency assessment during training evolved over a decade to become an activity based checklist, which included a standardized tool for objectively quantifying order processing. While useful, it was not comprehensive in assessing all aspects of pharmacy practice.

Action: Literature review focused on ongoing assessment of pharmacist competency. Further, we sought input from Canadian hospital colleagues. In conjunction with the American Society of Health System Pharmacist's competency textbook and the Canadian Pharmacy Residency Board standards, our existing checklist was redeveloped. Metrics were established in alignment with local practice to aid in assessment and tracking growth.

Evaluation: A scarcity of literature in ongoing assessment of pharmacist competency was noted. Our new tool has been used for trainee pharmacists and existing staff during work-withs. It has received positive feedback from trainers and trainees. In addition to tracking metrics, all sections of the tool include room for comments. If deficiencies are noted, a detailed action plan based on assessment results is to be developed.

Implications: Our tool is objective and better allows us to determine if individuals are meeting and maintaining competencies. Additionally, it serves to orientate staff to the department and helps them to feel prepared to practice in our facility. Though not validated, the tool is based on existing literature and may serve as a framework for others to adapt within their sites. Future work will focus further on clinical competencies.

Transition to Insulin Pens in Inpatient Rehabilitation and Mental Health Care Hospitals

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Background: Insulin is a high-alert medication that can cause significant harm when used in error. The"2017 Institute of Safe Medication Practices(ISMP) Guidelines for Optimizing Safe Subcutaneous Insulin Use in Adults", highlight best practices, including the recommendation to dispense insulin as patient-specific. Insulin pens have several advantages over insulin vials: more accurate dosing, less needle stick injury, less waste of insulin, less painful injection and they enable patient teaching. Insulin pens carry a risk of disease transmission if shared between patients, enhancing the need for education and safe dispensing practices.

Description: A joint collaboration between Pharmacy and Professional Practice was initiated to improve insulin safety. We implemented the transition from ward-stock insulin vials to patient-specific insulin pens across three of our inpatient sites (Physical Rehabilitation, Mental Health Care and Forensic Mental Health Care).

Action: We audited our insulin dispensing practices and compared these to best practice. We met and surveyed other hospitals, performed a cost analysis, developed dispensing workflows and engaged key stakeholders. All insulin vials and ward-stock insulin were removed and insulin is now dispensed as patient-specific insulin pens. Nursing staff completed a learning module on insulin pen safety and administration, followed by a return demonstration.

Evaluation: At 2 months post-transition, 80% of nursing staff have completed the mandatory education. Insulin scanning rates from 2 months prior compared to 2 months post-transition have either remained the same or increased (Physical Rehabilitation: 88% prior, 89% post; Mental Health Care: 45% prior,43% post; Forensic Mental Health Care: 79% prior, 93% post). Insulin medication errors are being tracked before and after the transition.

Implications: Several novel insulin products are only marketed as a pre-filled pen, compelling inpatient facilities to develop safe dispensing of these products. The transition to patient-specific insulin pens aligns with ISMP recommendations, provides consistent dispensing and enhances patient safety.

Point Prevalence Survey of Benzodiazepine and Sedative-Hypnotic Drug Use in Long-Term Care

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Introduction: Benzodiazepines and sedative-hypnotic drugs (BZD/SHD) are associated with cognitive impairment and falls among frail, older adults. While the use of these agents is well-known in community-dwelling older persons, prevalence of BZD/SHD use in long-term care residents is less understood although hypothesized to be high.

Objectives: To identify the point prevalence of BZD/SHD use in a 146 bed long-term care (LTC) facility and to explore the relationship between a fall history and current BZD/SHD use.

Methods: A point prevalence survey (PPS) was conducted by reviewing the health records of adults in a LTC facility. BZD/SHD utilization was defined as having received an oral BZD/SHD within the 24 hours prior

to the survey. Patient demographics, BZD/SHD utilization, indication, use prior to LTC admission and fall history in the past 6 months were collected. Results were summarized descriptively.

Results: Overall prevalence of BZD/SHD use was 45.2% (66/146). The average age of residents was 91 years old, 87.9% of BZD/SHD users were ≥ 85 years old and 28.8% were ≥ 95 years old. The most commonly used drugs for residents receiving at least one BZD/SHD were trazodone (39.5%) and melatonin (38.3%). The majority of use (71.6%) had been initiated after admission to the LTC facility. In the past 6 months, 44.3% (47/106) of residents had at least one fall and 53.2% (25/47) of those residents were currently taking a BZD/SHD.

Conclusions: BZD/SHDs were used by 45% residents in the LTC facility. Areas identified for quality improvement included investigating strategies to minimize BZD/SHD use in the LTC setting, particularly for those with a history of falls; and ensuring that when BZD/SHD use is appropriate, it is used at the lowest effective dose and for the shortest duration of time.

Benzodiazepine and Sedative-Hypnotic Drug Use in Hospital: Perspectives from Healthcare Providers

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Background: A point prevalence survey (PPS) conducted in the province's acute care hospitals found that the overall prevalence of benzodiazepine and sedative-hypnotic drug (BZD/SHD) use was 35%, with almost 40% of these drugs being newly started in hospital. A scoping review of interventions to decrease BZD/SHD use in hospitals is needed to determine current evidence and research gaps.

Objective: To gauge the opinions of healthcare providers and patients on BZD/SHD used for sleep and anxiety in hospital to inform a scoping review.

Methods: Healthcare providers, patients and their families were invited, via a standardized email, to participate in stakeholder meetings being held in person at the hospital from May 1 to May 4, 2018. Stakeholders were asked open-ended questions surrounding their experience with sleeping pill use in the hospital, how to change sleeping pill use, other options for insomnia or anxiety, and resources available to decrease BZD/SHD use in the hospital. Meetings were recorded, transcribed, and coded into categories, sub-categories and keywords. Results were summarized descriptively.

Results: Twenty-one participants attended three group meetings and two individual meetings. Nurses, physicians and pharmacists most commonly discussed solutions and barriers. Top solutions were related to the need for education, finding alternatives to BZD/SHD use, medication reviews, discussing tapered withdrawal with the patient, and improving the hospital environment to promote sleep. Barriers identified included a disruptive hospital environment, the ease of prescribing BZD/SHDs, difficulty making changes to home medications and staff not being aware of the risks of using BZD/SHDs.

Conclusions: A number of barriers and solutions for improving BZD/SHD drug use in hospital were identified. Stakeholder feedback will be used to inform both the scoping review and potential interventions that can be implemented to reduce BZD/SHD in hospital.

Investigation of the Average Duration of Dual Antiplatelet Therapy in Dialysis and Pre-Dialysis Patients

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Background: The use of dual antiplatelet therapy (DAPT) with aspirin and a $P2Y_{12}$ receptor antagonist has been well-studied in the secondary prevention of acute coronary syndromes (ACS). Both the American and Canadian DAPT guidelines broadly recommend a duration of 12 months of DAPT post-ACS, with recent literature recommending up to 3 years of DAPT in certain clinical scenarios. Although chronic kidney disease (CKD) is a known risk factor for both thrombotic and bleeding events, studies evaluating the optimal duration of DAPT often exclude or minimally represent CKD patients.

Objectives: This study examined the average duration of DAPT, clinical factors impacting DAPT duration and whether DAPT was being reassessed in hemodialysis, peritoneal dialysis and pre-dialysis patients at a hospital with a regional dialysis centre.

Methods: A retrospective chart review was performed in adult CKD patients that suffered an ACS event and started DAPT between January 1, 2014 and March 1, 2017.

Results: The average duration of DAPT was 366 days (N=65), with a bimodal distribution, defining two subgroups – those on DAPT for <365 days (33 patients) and those on DAPT for >365 days (32 patients). Documentation of a bleed/increased bleed risk was the primary reason DAPT was stopped before 1 year. Statistically significant factors associated with a shorter DAPT duration (<365 days) included concomitant use of medications that increase bleeding risk. Both proton pump inhibitor use and having peripheral artery disease were statistically significant factors associated with a longer DAPT duration (>365 days). Reassessment of DAPT by the renal pharmacist was documented for 28% of patients.

Conclusion: DAPT duration in CKD patients is highly variable and impacted by numerous factors. These results point toward the need for further investigation of optimal DAPT duration and a more tailored reassessment of DAPT in the CKD population.

Revue de l'utilisation de l'eculizumab

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Contexte: L'éculizumab est indiqué dans le traitement des hémoglobinuries paroxystiques nocturnes (HPN) et des syndromes hémolytiques urémiques (SHU) atypiques.

Objectif(s): Décrire l'utilisation de l'éculizumab dans un centre hospitalier universitaire.

Méthodologie: Étude descriptive rétrospective des patients ayant reçu de l'éculizumab du 1-1-2011 au 1-6-2018. Des données liées aux caractéristiques démographiques (genre, poids, âge), au diagnostic (étiologie, critères diagnostic, durée d'hospitalisation), aux conditions de prescription et d'administration (vaccination, antibioprophylaxie, dose, durée et coût du traitement) et à l'évolution (réhospitalisation, retraitement, survie) ont été recueillies.

Résultats: 29 patients (20 filles, 9 garçons) ont reçu au moins une dose d'éculizumab soit 22 patients avec microangiopathie thrombotique (MAT), (16 MAT secondaires, quatre SHU secondaires à une infection à E.coli producteur de Shigatoxine, deux SHU atypiques), une HPN, cinq glomérulonéphrites à C3, un rejet humoral de greffe de rein. L'âge médian au traitement était de 8ans [min=1-max=39]. 21 patients (72%) étaient hospitalisés au diagnostic avec une durée médiane d'hospitalisation de 39jours [1-464]; 16 patients (59%) ont dû être hospitalisés en soins intensifs pour une durée médiane de 13jours [1-59]. Dans les cas de MAT secondaire, dix traitements (62,5%) suivent une greffe de moelle, deux (12,5%) une chimiothérapie sans greffe, un (6,25%) une hypertension artérielle, deux (12,5%) sont d'origine indéterminée et huit patients présentaient une réaction du greffon contre l'hôte associée. 100% des patients ont été vaccinés contre le méningocoque ou ont reçu une antibioprophylaxie. Les patients ont reçu un nombre médian de doses de 6 [1-172] sur une durée médiane de 93 jours [1-2778]. Sept patients (24,1%) ont dû être hémodialysés et 14 (48,3%) réhospitalisés. Un coût médian/patient de 114884$ [7180-3755260] a été calculé.

Conclusion(s): L'éculizumab a été utilisé dans trois cas selon les indications du fabricant et dans 26 cas hors-monographie. Il est nécessaire d'utiliser un programme d'encadrement de l'utilisation émergente

Preliminary Evaluation of the NAPRA 6-hour Rule for Single-Use Vials after First Puncture in an ISO-5 Environment

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Background: The USP-797 and NAPRA guidelines related to the 6-hour Beyond-Use-Dating (BUD) limit is not aligned with other BUD guidelines (11-days) for a low-risk product compounded from a single use vial.

Objective: To evaluate sterility of single use vials test following multiple withdrawals over a 7 day sampling period.

Methods: One 20-mL vial containing sterile TSB growth medium was placed in each of 5 laminar air flow hoods weekly. 1-mL samples were drawn from each vial immediately after placement in the hood and at 48 and 168hours. Prior to sample withdrawal vials were visually inspected for turbidity. After 1 week, vials were collected, incubated at 37oC for 14-days and inspected visually every 2 days for evidence of contamination (turbidity). For positive controls, three TSB vials were inoculated with less than 102 of *S.epidermidis* ATC12228. As a negative control, three unopened vials of TSB were incubated for 14 days. The contamination rate was calculated based on the 95% confidence interval constructed around the observed contamination rate per 100 vials and per 100 transfers.

Results: All positive control vials demonstrated growth within 48-hours. All negative control vials showed no growth. During the first 20-weeks of monitoring, all vials (100 vials – 300 transfers) remained sterile following storage at room temperature for 7 days and subsequent incubation for 14-days. The 95%-CI of the contamination rate is 0.000 to 0.017% per transfer.

Conclusions: Single-use-vials, aseptically punctured within an ISO-5 environment, maintain sterility following multiple withdrawals over 7-days.

Physical Compatibility and Stability of Ascorbic Acid Injection in Polyvinyl Chloride Minibags at 4°C and Room Temperature (25°C)

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Background: Emerging data suggests intravenous ascorbic acid (AA) may be a potential therapy in patients presenting with severe sepsis. Stability of diluted AA is not known beyond 24 hours.

Objective: To evaluate the physical compatibility and chemical stability of AA injection diluted in either 50mL NS or D5W PVC minibags during storage over 14 days at 25°C and at 4°C, protected from light (PFL).

Methods: On study day 0, 36mg/mL and 77mg/mL concentrations (Sandoz) and 40mg/mL and 92mg/mL concentrations (Mylan) of AA were prepared and PFL. 3 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, 0.33, 1, 1.33, 2, 3, 4, 7, 10 and 14. AA concentrations were determined by a validated stability-indicating liquid chromatographic method with UV detection. Chemical stability was calculated from 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 AA such that the concentration was measured specifically, accurately (deviations from known averaged <2.2%) and reproducibly (replicate error averaged <1.82% (CV[%]). During the study period at 4°C all solutions retained more than 97.7% of the initial concentration and at 25°C more than 88% remained after 14 days, for both manufacturers. Study days and temperature significantly affected the percent remaining ($p<0.001$) but solution ($p>0.495$), concentration ($p>0.732$) and manufacturer ($p>0.808$) had no significant effect.

Conclusions: AA concentrations between 36 and 92 mg/mL, diluted in either NS or D5W and stored in PVC minibags are physically and chemically stable for at least 14 days at 4°C and 10 days at room temperature (25°C) with PFL. Establishing a Beyond Use Date should be based on current NAPRA/USP-797 Guidelines.

Stability of 2.5mg/mL Indocyanine Green (ICG) Solutions Stored in Syringes at 25°C, 4°C, -20°C and -67°C

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Background: Due to increasing use of ICG, waste and recent backorders, chemical stability data was sought to preserve inventory.

Objective: To evaluate the chemical stability of ICG prepared in polypropylene (PP) syringes at concentrations of 2.5mg/mL reconstituted with Sterile Water for Injection (SWFI) and stored at 25°C, 4°C and in the freezer (-20°C and -67°C)

Methods: On study day 0, ICG solutions of 2.5mg/mL were prepared in 5mL PP syringes, reconstituted with SWFI. Three syringes were stored at 25°C, 4°C, -20°C or -67°C. ICG concentrations were determined 8 times over each study period at each temperature using a validated stability indicating analytical method. 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 ICG such that the concentration was measured specifically, accurately and reproducibly (1.73% (CV(%)). Analysis of variance revealed significant differences in percent remaining due to study day (p=0.009) and temperature (p=0.035). The calculated T-90, with 95% confidence, exceeded the 28-day study period for syringes stored in the freezer at either -20°C or -67°C. The calculated T-90, with 95% confidence, was 34.11 hours at 25°C and 37.38 hours at 4°C.

Conclusions: We conclude that 2.5mg/mL solutions of ICG may be stored frozen at -20°C or -67°C for up to 28 days, but at 4°C or 25°C, solutions should be stored for only 36-hours. Syringes stored in the freezer for up 28-days can be withdrawn from the freezer, allowed to thaw, but should be used within 24-hours of withdrawal from the freezer. Under these conditions more than 92.5% of the initial ICG concentration will remain at 24 hours.

Development of an On-Going Sterility Monitoring Program for Single-Use Vials Undergoing Multiple Access Following Application of a Closed System Transfer Device

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Background: Closed system transfer devices (CSTD) are designed to protect healthcare workers from exposure to hazardous drugs. These devices have also been shown to minimize microbial contamination of single use vials (SUV). However, NAPRA has suggested that annual testing of the CSTD is necessary to assure continued sterility. Since validation requires more than 3000 transfers, the feasibility of an on-going monitoring program was investigated.

Objective: To test whether attaching a CSTD (Equashield®) to SUVs can minimize microbial contamination and extend the "use-by" date following multiple withdrawals under extreme-use-conditions.

Methods: An Equashield® vial adapter was attached to one 20-mL vial containing sterile TSB growth medium and placed in each of 4 biological safety cabinets weekly. 1-mL samples were drawn from each vial at immediately following application of the CSTD and at 48 and 168 hours. Prior to sample withdrawal vials were visually inspected for turbidity. After 1 week, vials were collected, incubated at 37oC for 14-days and inspected visually every 2 days for evidence of contamination (turbitidy). For positive controls, three TSB vials were inoculated with less than 102 of *S.epidermidis* ATC12228. As a negative control, three unopened vials of TSB were incubated for 14 days. Stopping rules included growth in 2 CSTD vials in fewer than 100 consecutive vials (contamination rate using lower limit of 80%-Confidence Interval (CI) is greater than 0.20%).

Results: All positive control vials demonstrated growth within 48-hours. All negative control vials showed no growth. During the first 20-weeks of monitoring, all CSTD vials (80 vials – 240 transfers) remained sterile following storage at room temperature for 7 days and subsequent incubation for 14-days. The 95%-CI of the contamination rate is 0.000 to 0.021%.

Conclusions: Attachment of a CSTD to single-use-vials within an ISO-5 environment has the ability to maintain sterility following multiple withdrawals over 7-days.

Stability of 0.04, 0.1, and 0.2 mg/mL Vitamin K (Phytonadione) in 5% Dextrose in Water Solutions Stored in Polyvinyl Chloride Bags at 4°C over 9 Days

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Background: To our knowledge, no stability data exist for 0.04, 0.1 and 0.2 mg/ml intravenous vitamin K (phytonadione) solutions in 5% dextrose in water (D5W) in polyvinyl chloride (PVC) bags.

Objectives: To test the physical and chemical stability of the 0.04-0.2 mg/ml vitamin K solutions in D5W over 9 days at 4°C.

Methods: Prepared solutions were stored at 4°C for 9 days, with samples taken daily and frozen pending analysis. Samples from selected days throughout the study were analysed in quintuplicate by gas chromatography/mass spectrometry, with vitamin K-d7 as the internal standard (ISTD). Vitamin K/ISTD peak area ratios (PARs) were calculated for and compared to those of Day 0 by calculating them as a percentage of the Day 0 value. Mass spectra of Day 9 drug peaks were compared to those of Day 0 peaks to confirm purity. Physical stability was assessed visually daily.

Results: The vitamin K concentration in the preparation of 0.04 mg/ml vitamin K in D5W declined, with the lower 95% confidence limit falling below 90% of the Day 0 value within 45 hours. The lower limits of the 95% confidence intervals of the 0.1 & 0.2 mg/ml vitamin K solutions always remained above 90% of the day 0 values. Day 9 mass spectra of all solutions were identical to those of Day 0. All solutions remained visually consistent over the 9 days.

Conclusions: These data support 0.1 & 0.2 mg/ml vitamin K solutions in D5W as physically and chemically stable for 9 days, but 0.04 mg/ml vitamin K in D5W was chemically stable for less than 2 days.

Élaboration d'outils et de politiques et procédures sur les préparations stériles

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Contexte : En 2014, l'Ordre des pharmaciens du Québec (OPQ) a publié les normes 2014.01 et 2014.02 sur la préparation de produits stériles non dangereux et non dangereux en pharmacie. Les départements de pharmacie ont l'obligation de répondre aux exigences de ces 2 normes, notamment en élaborant des politiques et procédures (P&P) sur les différents aspects de la préparation de produits stériles.

Description : Soutenir les départements de pharmacie en proposant une série d'outils et de P&P adaptés aux exigences de ces 2 normes.

Action : Sur la base des publications disponibles sur le sujet, élaborer des outils et P&P requis par les 2 normes. S'assurer que les outils et P&P soient adaptables aux réalités de tout type d'établissement.

Évaluation : Un groupe de travail composé de 7 pharmaciens pratiquant dans le domaine des préparations stériles a été créé avec pour mandat d'élaborer des outils et des P&P. Avant d'être publiés, les outils et P&P ont franchi les étapes suivantes : rédaction, validation en groupe, révision scientifique, validation des commentaires, révision linguistique et mise en page. Le groupe de travail a publié 103 outils et P&P abordant les thèmes suivants : personnel et installations, préparations stériles et gestion de la qualité. Il a également publié : une foire aux questions, une boîte à outils et une procédure d'évaluation bisannuelle des compétences des pharmaciens désignés au soutien.

Répercussions : La possibilité d'utiliser ces outils et P&P adaptables se traduit par une économie d'heures considérable pour les départements de pharmacie. Ils servent également de références pour l'évaluation et la formation du personnel assigné à ce secteur et à la standardisation des pratiques. Un sondage de satisfaction a révélé que 95 % (142 sondés sur 149) des pharmaciens ayant utilisé les outils et P&P les ont cotés 4 ou 5 (5 étant le maximum).

Stability of 9.1, 10.7 and 16.7 mg/mL Calcium Gluconate Solutions in Normal Saline and/or 5% Dextrose in Water Stored in Polyvinyl Chloride Minibags at 4°C over 9 Days

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Background: To our knowledge, no stability data exist for 9.1, 10.7 or 16.7 mg/ml calcium gluconate solutions in 5% dextrose in water (D5W) or normal saline solutions stored in polyvinyl chloride (PVC) bags at 4°C.

Objective: To test the physical and chemical stability of the calcium gluconate solutions, in diluents D5W or normal saline, stored in PVC minibags at 4°C for 9 days.

Methods: The calcium gluconate solutions were stored in PVC bags at 4°C for 9 days. Samples were taken daily and frozen at -80°C, pending analysis. Samples from selected days were analysed in quintuplicate on a Roche Cobas C 701 analyzer. Calcium concentration means from each selected day were compared to those of Day 0 by calculating them as a percentage of the Day 0 value. Chemical stability was demonstrated if the lower limit of the 95% confidence interval did not fall below 90% of the Day 0 value. Physical stability was assessed by daily colour and clarity observation.

Results: The lower limits of the 95% confidence intervals of all of the solutions remained above 90% of the Day 0 concentration for the entire 9 day study. All of the calcium gluconate solutions remained clear and colourless throughout the study.

Conclusion: These data support the assignment of a beyond-use date of 9 days for preparations of 9.1, 10.7 and 16.7 mg/ml calcium gluconate with diluents of either normal saline or D5W in PVC bags at 4°C.

My Last Brush Stroke

Myrella Roy, Executive Director, 2003–2018

The year 2018 marked the end of my tenure as chief staff officer of the Canadian Society of Hospital Pharmacists (CSHP), after more than 15 amazing and rewarding years. By the time you read these lines, I will have embarked on the retirement chapter of my life. In the present report, I would like to take you through the extensive gallery of CSHP's accomplishments exhibited during this last year and over the past 15 years.

The Steering Committee of the Excellence in Hospital Pharmacy masterpiece program drew inspiration from the responses to surveys of patients and CSHP members conducted in late 2017. These surveys requested valuation of how the 3 program themes—patient-centred care, best practice, and communication and collaboration—are expressed in the care provided to patients by hospital pharmacy teams. Based on the survey responses, realistic and aspirational targets were set to measure the performance of care embodied in the priority themes. The survey report (entitled *What Patients and Members Told Us about Patient Care*), the program's targets, and issues of the new electronic newsletter, *Excellence Express*, are available at https://www.cshp.ca/excellence.

Thanks to input from the organization's muses, its members, CSHP engaged in the Choosing Wisely Canada movement (https://choosingwiselycanada.org/recommendations/). Six recommendations were drawn, appealing for pharmacists practising in hospitals and other collaborative healthcare settings to reduce commonly used but unnecessary drug treatments that are not supported by evidence and could expose patients to harm.

CSHP and the Association des pharmaciens des établissements de santé du Québec (A.P.E.S.) produced a collective artwork: an entirely revised strategic alliance that depicts an exciting new opportunity for the members of both organizations. Current CSHP members can now avail themselves of the same benefits and services as those enjoyed by A.P.E.S. associate members, at no additional cost. Similarly, CSHP offers to interested A.P.E.S. active members the same rights and benefits as it grants to its individual supporters, at no additional cost. Through their renewed strategic alliance, CSHP and A.P.E.S. are also endeavouring to accentuate their advocacy voice throughout Canada—promoting how pharmacists from hospitals and other collaborative healthcare settings contribute to the improvement of the health and quality of life of Canadians—and to foster nationwide exchanges and consultation among hospital pharmacy experts.

In the advocacy exhibition room, 2 illustrative topics were prominently displayed on easels. First, CSHP responded to an invitation from the Advisory Council on the Implementation of National Pharmacare to recommend Society members who could speak authoritatively about pharmacare and represent the organization's position in a series of cross-Canada roundtables during the summer. Of the 33 members recommended by CSHP, 14 were invited by the Advisory Council to 9 roundtables. The Advisory Council's final report is expected in the spring of 2019. Second, CSHP has continued to voice to Health Canada the concerns of its membership about the mandatory reporting by hospitals of serious adverse drug reactions and medical device incidents. This advocacy effort entailed making representations on the proposed amendments to Canada's Food and Drug Regulations and the accompanying cost–benefit analysis; twice participating with A.P.E.S., at Health Canada's invitation, in private discussions on the proposed regulations and on next steps toward their enactment; and joining the Advisory Panel on Outreach, Education and Feedback.

Also showcased in the gallery were CSHP's responses to calls for consultation from the following stakeholders: Health Canada, on proposed regulations on the monitoring of medical assistance in dying, on the renewal of the Special Access Programme, and on the notice of intent to restrict the marketing and advertising of opioids and the subsequent cost–benefit analysis of the related proposal; and HSO (Health Standards Organization), on the *Medication Management* standard.

CSHP added several valuable items to its collection: the Canadian Medication Optimization Briefing *Safe Transitions of Care for Patients Taking Opioids* (https://www.cshp.ca/canadian-medication-optimization-briefing-0), the *Hospital Pharmacy in Canada Report 2016/17* (www.hospitalpharmacysurvey.ca), and the *Telepharmacy: Guidelines* (https://www.cshp.ca/guidelines). CSHP's artists in residence are also putting the finishing touches on a monumental work, *Controlled Drugs and Substances in Hospitals and Healthcare Facilities: Guidelines on Secure Management and Diversion Prevention*, which will be on open display very soon. Furthermore, CSHP and other healthcare organizations partnered in the Royal College of Physicians and Surgeons of Canada's project to create the ebook *Navigating Medical Emergencies: An Interactive Guide to Patient Management* (https://www.cshp.ca/clinical-pharmacy); *Hospital News* collaborated with CSHP to portray hospital pharmacy practice in its June 2018 edition (https://issuu.com/hospitalnews/docs/hospital_news_june_2018_edition); and Elsevier—a global information analytics business specializing in science and health—commissioned CSHP to paint the chapter "Hospital Pharmacy Practice: A Case Study from Canada" in the original edition of *Encyclopedia of Pharmacy Practice and Clinical Pharmacy*, which is expected to be released online in June 2019 (https://www.elsevier.com/books/ encyclopedia-of-pharmacy-practice-and-clinical-pharmacy/ babar/978-0-12-812735-3).

Art galleries and CSHP alike are embracing technology with similar ends in mind: the former to engage visitors and enrich their experience with art, the latter to better engage its members and enrich their experience with the organization. In the past year, CSHP has upgraded its association management system, the computer software that supports the provision of services to members. Through the system's interface with the enhanced member portal on CSHP's website, members can more easily manage their profile online, interact and transact with the organization, and contact their peers.

CSHP has continued to flourish under the watchful eye of its staff curators. Each and every one of these 15 dedicated employees deserves public accolade, with a few highlighted here for appreciation in 2018. Several milestone employment anniversaries were celebrated: 5 years for Susan Maslin (Event Planning and PSNs Administrator), 10 years for Cathy Lyder (Director, Members and Programs), 15 years for Janet Lett (CSHP Foundation Administrator), and 25 years for Gloria Day (Canadian Pharmacy Residency Board Administrator). Laurie Frid (General Program Administrator) and Amanda Iannaccio (Publications Administrator) were welcomed back, Laurie after her leave of absence and Amanda after her pregnancy and parental leave. Finally, Christopher Doody (Interim Publications Administrator) and Olga Chrzanowska (Web Administrator for nearly 10 years) received warm send-offs.

As for the 15-year retrospective, contrary to the idiom "a picture is worth a thousand words", I leave you with hundreds of words sketching an Impressionist picture: a word cloud generated from all of my Executive Director's Reports.

With my undying gratitude,

Myrella Roy, BScPhm, PharmD, FCCP
Former Executive Director (2003–2018)
Canadian Society of Hospital Pharmacists

Mon dernier coup de pinceau

Myrella Roy, directrice générale de 2003 à 2018

L'année 2018 a marqué la fin de mon mandat à titre de cadre supérieur de la Société canadienne des pharmaciens d'hôpitaux (SCPH) après plus de 15 merveilleuses années gratifiantes. Au moment où vous lirez ces lignes, je me serai engagée dans le chapitre de ma vie consacré à la retraite. J'aimerais profiter de ce rapport pour m'imaginer une promenade avec vous dans la vaste galerie exposant les succès accomplis par la SCPH en 2018 et au cours des 15 dernières années.

Le comité directeur du programme Excellence en pharmacie hospitalière, le chef-d'œuvre, s'est inspiré des réponses aux sondages réalisés à la fin 2017 auprès de patients et de membres de la SCPH. Ces sondages demandaient d'expertiser comment les trois thèmes du programme – les soins centrés sur le patient, les meilleures pratiques, et la communication et la collaboration – se traduisent dans les soins prodigués aux patients par les équipes de pharmacies hospitalières. Selon les réponses aux sondages, des cibles réalistes et ambitieuses ont été établies afin d'évaluer le rendement des soins exprimés par les thèmes centraux. Le rapport d'enquêtes (intitulé *What Patients and Members Told Us about Patient Care*), les cibles du programme et les numéros de la nouvelle infolettre, *Excellence Express*, sont disponibles au https://www.cshp.ca/excellence.

Grâce aux concours des muses de l'organisme (ses membres), la SCPH a pris part au mouvement Choisir avec soin Canada (https://choisiravecsoin.org/recommandations/). Six recommandations ont été formulées, incitant les pharmaciens qui exercent dans les hôpitaux et les autres milieux de soins de santé misant sur la collaboration à réduire les pharmacothérapies couramment utilisées mais superflues qui ne sont pas appuyées sur des données probantes et qui pourraient être nuisibles aux patients.

La SCPH et l'Association des pharmaciens des établissements de santé du Québec (A.P.E.S.) ont créé une œuvre d'art collective : une alliance stratégique entièrement mise à jour qui représente une occasion intéressante à saisir pour les membres des deux organismes. Les membres actuels de la SCPH peuvent maintenant jouir des mêmes avantages et services dont profitent les membres associés de l'A.P.E.S., et ce, sans frais supplémentaires. De même, la SCPH offre aux membres actifs de l'A.P.E.S. qui le désirent les mêmes droits et avantages qu'elle accorde à ses partisans individuels, et ce, sans frais supplémentaires. À la faveur de leur alliance stratégique remaniée, la SCPH et l'A.P.E.S. s'efforcent aussi d'accentuer leur voix collective partout au Canada – comme porte-paroles des pharmaciens qui se consacrent à améliorer la santé et la qualité de vie des Canadiens dans les hôpitaux et les autres milieux de soins de santé misant sur la collaboration – et de favoriser les échanges et les consultations entre experts de la pharmacie hospitalière à l'échelle nationale.

Dans la salle d'exposition de la valorisation, deux thèmes illustratifs ont été disposés bien en vue sur des chevalets. D'abord, la SCPH a répondu à une invitation du Conseil consultatif sur la mise en œuvre d'un régime national d'assurance-médicaments lui demandant de recommander des membres de la Société qui pourraient parler avec confiance au sujet d'un régime d'assurance-médicaments et exposer la position de l'organisme au cours d'une série de tables rondes pancanadiennes pendant l'été. Parmi les 33 membres recommandés par la SCPH, 14 ont été invités par le Conseil consultatif à participer à neuf tables rondes. Le rapport final du Conseil consultatif est attendu pour le printemps 2019. Deuxièmement, la SCPH a continué de communiquer à Santé Canada les préoccupations de ses membres concernant la déclaration obligatoire des réactions indésirables graves aux médicaments et des incidents relatifs aux instruments médicaux par les hôpitaux. Ce travail de valorisation nécessitait : de formuler des remarques sur les modifications proposées au Règlement sur les aliments et drogues du Canada et l'analyse des coûts et avantages complémentaire; de participer avec l'A.P.E.S., à la demande de Santé Canada en deux occasions, à des discussions privées sur le projet de règlement et sur les étapes suivantes menant à sa promulgation; et de participer au Groupe consultatif sur la sensibilisation, l'éducation et la rétroaction.

Dans la galerie sont aussi présentées les réponses de la SCPH aux demandes de consultation des parties prenantes suivantes : Santé Canada, au sujet du projet de règlement sur la surveillance de l'aide médicale à mourir, sur le renouvellement du Programme d'accès spécial et sur l'avis d'intention de restreindre le marketing et la publicité des opioïdes ainsi que l'analyse des coûts-avantages subséquente de la proposition connexe; et HSO (Health Standards Organization en anglais, c.-à-d. l'Organisation de

normes en santé) quant à la norme sur la *Gestion des médicaments*.

La SCPH a ajouté plusieurs éléments précieux à sa collection : la Synthèse canadienne sur l'optimisation de la médication (c.-à-d. Canadian Medication Optimization Briefing en anglais) intitulée *Safe Transitions of Care for Patients Taking Opioids* (https://www.cshp.ca/canadian-medication-optimization-briefing-0), le *Rapport sur les pharmacies hospitalières canadiennes 2016-2017* (www.hospitalpharmacysurvey.ca) et les *Lignes directrices sur la prestation de services de télépharmacie* (https:// www.cshp.ca/guidelines). Les artistes en résidence de la SCPH mettent aussi la touche finale à une œuvre monumentale, *Controlled Drugs and Substances in Hospitals and Healthcare Facilities : Guidelines on Secure Management and Diversion Prevention*, qui sera en présentation libre d'ici peu. De plus, la SCPH et d'autres organismes de soins de santé ont concouru au projet du Collège royal des médecins et chirurgiens du Canada afin de créer un livre numérique intitulé *Naviguer les urgences médicales : Un guide interactif sur la prise en charge du patient* (https://www.cshp.ca/clinical-pharmacy); *Hospital News* a collaboré avec la SCPH dans le but d'illustrer la pratique de la pharmacie hospitalière dans son numéro de juin 2018 (https://issuu.com/hospitalnews/docs/hospital_news_june_2018_edition); et Elsevier – une entreprise internationale d'analyse de l'information spécialisée en science et en santé – a passé commande à la SCPH du chapitre peignant « Hospital Pharmacy Practice: A Case Study from Canada » dans l'édition originale de l'*Encyclopedia of Pharmacy Practice and Clinical Pharmacy*, qui sera publiée en ligne en juin 2019 (https://www.elsevier.com/books/encyclopedia-of-pharmacy-practice-and-clinical-pharmacy/babar/978-0-12-812735-3).

Les galeries d'art et la SCPH ont toutes deux adopté la technologie pour des buts semblables : les premières afin d'engager les visiteurs et d'enrichir leur expérience de l'art et la seconde afin de mieux engager ses membres et d'enrichir leur expérience au sein de l'organisme. Au cours de la dernière année, la SCPH a mis à jour son système de gestion d'association, le logiciel sur lequel s'appuie la prestation des services aux membres. Grâce à l'interface du système avec le portail amélioré des membres sur le site Web de la SCPH, les membres peuvent plus facilement gérer leur profil en ligne, interagir et faire affaire avec l'organisme, et communiquer avec leurs pairs.

La SCPH a continué de prospérer sous le regard vigilant des commissaires d'exposition à son emploi. Chacune de ces 15 employées dévouées méritent des éloges publics, mais je réserve ici une pensée particulière à seules quelques-unes d'entre elles en 2018. Plusieurs anniversaires d'embauche marquants ont été célébrés cette année : 5 ans pour Susan Maslin (agente de la planification des événements et des réseaux de spécialistes en pharmacie), 10 ans pour Cathy Lyder (directrice, secteur des membres et des programmes), 15 ans pour Janet Lett (agente de la Fondation de la SCPH) et 25 ans pour Gloria Day (agente du Conseil canadien de la résidence en pharmacie). De plus, Laurie Frid (agente générale de programmes) et Amanda Iannaccio (agente des publications) ont été accueillies de nouveau parmi nous : Laurie après une absence autorisée et Amanda après son congé de maternité et son congé parental. Enfin, Christopher Doody (agent intérimaire des publications) et Olga Chrzanowska (agente du Web pendant près de 10 ans) ont eu droit à des adieux chaleureux.

Pour ce qui est de la rétrospective des 15 dernières années, afin de faire mentir l'expression « une image vaut mille mots », je vous laisse des centaines de mots qui esquissent une image impressionniste : un nuage de mots-clés tirés de l'ensemble de mes rapports de directrice générale.

Veuillez recevoir ma reconnaissance éternelle.

Myrella Roy, B. Sc. Phm., Pharm. D., FCCP
Ancienne directrice générale (de 2003 à 2018)
Société canadienne des pharmaciens d'hôpitaux

Le vent du changement souffle toujours

par Patrick Fitch

Il y a deux ans, dans mon premier commentaire en tant que membre de l'équipe présidentielle de la Société canadienne des pharmaciens d'hôpitaux (SCPH) (*J. Can. Pharm. Hosp.* 2016; 69[5]:431) je me suis exprimé sur certains changements qui étaient intervenus peu auparavant au sein de notre profession et de la Société. En entamant ma dernière année à titre de membre de la direction de la SCPH, j'ai pensé qu'il serait opportun de me pencher à nouveau sur ce thème. D'importants changements se produiront à la SCPH et bon nombre d'entre eux influenceront la direction de la Société à l'avenir.

Le plus important est celui qui touche la direction. Le 31 décembre 2018, après 15 ans à la barre de la SCPH, la directrice générale, Myrella Roy, a cédé sa place à Jody Ciufo, qui a officiellement repris les rênes de la Société le 2 janvier 2019. Jody a une vaste expérience de la gestion associative et elle est prête à relever le défi que représente la direction de la SCPH dans les années à venir.

Lorsque Myrella Roy a annoncé son départ, le conseil a pensé que le moment était venu de mettre à jour le pendant anglais du titre du poste le plus élevé dans la direction de la SCPH. Or, aucun changement n'a été apporté au titre du poste qui, en français, demeure celui de directrice générale. Peut-être vous demandez-vous pourquoi le conseil a décidé de modifier le titre du poste le plus élevé de notre organisme. Historiquement, les cadres supérieurs des organismes sans but lucratif avaient le titre de « *executive director* ». Or, au cours des trois dernières décennies, bon nombre d'organismes ont décidé d'adopter le titre de « *chief executive officer* » pour se calquer sur le monde des affaires. Cependant, ce changement n'a pas lieu pour l'équivalent français, donc Jody conservera le titre directrice générale.

L'actuel plan stratégique de la SCPH arrivera à terme en 2020 et le travail d'élaboration du prochain plan est déjà amorcé. Le conseil se réunira en octobre 2019 pour participer à un atelier de planification d'une journée. Pour préparer cette rencontre, il s'est engagé à faire une évaluation stratégique de l'ensemble des programmes et services de la SCPH en gardant à l'esprit deux objectifs : guider le processus de planification stratégique et cibler les changements à apporter aux programmes et services qui feront de la SCPH un organisme plus fort.

L'équipe de liaison interne n'a pas chômé non plus. Lorsque nous avons pris conscience que nous n'atteindrions pas les cibles d'adhésion du plan stratégique actuel, un groupe de travail composé de membres du conseil, du comité d'adhésion et de présidents de sections a été mis en place pour élaborer des stratégies de recrutement et de fidélisation. Ces stratégies ont été approuvées par le conseil en avril 2018. Depuis lors, elles sont prioritaires, des groupes de travail supplémentaires ont donc été mis sur pied pour développer des activités de mise en œuvre.

Le conseil a aussi longuement étudié l'avenir de la Conférence sur la pratique professionnelle et un groupe de travail a été mis sur pied afin de trouver le moyen de la revitaliser au moment de célébrer son 50e anniversaire. Le travail d'évaluation de l'ensemble des programmes de formation de la SCPH se poursuit afin que soient offertes à nos membres des formations de qualité à la hauteur de leurs attentes .

Le programme de reconnaissance a lui aussi fait l'objet d'un examen et des changements s'annoncent, tant pour le programme national que pour celui des sections. L'objectif vise à rationaliser les propositions de prix pour éviter les redondances.

Au moment où la SCPH évalue ses programmes et services, nous sollicitons de plusieurs façons des commentaires de la part de nos membres : enquêtes, sondages, médias sociaux. J'invite tous les membres à nous faire part de leurs opinions le moment venu.

Je crois qu'une période stimulante s'amorce pour la SCPH et j'ai hâte de voir ce qui nous attend.

[Traduction par l'éditeur]

Patrick Fitch, B. S. P., A. C. P. R., est président sortant et agent de liaison interne pour la Société canadienne des pharmaciens d'hôpitaux.

The Winds of Change Continue

Patrick Fitch

Two years ago, in my first commentary as a member of the presidential team of the Canadian Society of Hospital Pharmacists (CSHP) (*Can J Hosp Pharm*. 2016;69[5]:432), I wrote about some of the changes that had occurred recently within our profession and the Society. I thought it would be timely, as I begin my final year as a member of the CSHP Executive, to revisit that theme. Significant changes are coming to CSHP, many of which will influence the direction of the Society in the future.

The biggest change is a transition in office leadership. After 15 years at the helm, CSHP's Executive Director, Myrella Roy, retired on December 31, 2018, and on January 2, 2019, Jody Ciufo officially took over as Chief Executive Officer. Jody brings a wealth of experience from the association management world and is looking forward to the challenge of leading CSHP in the years ahead.

You may be wondering why the Board decided to change the title of our most senior employee. When Myrella Roy announced her retirement, the Board agreed that this time of transition would be perfect to update CSHP's most senior manager's title. Historically, senior managers of not-for-profit organizations have held the title of "executive director". However, over the past 30 years or so, many organizations have changed the title to "chief executive officer", following a common business practice.

The current CSHP strategic plan is due to conclude in 2020, and work has already begun on the next strategic plan. The Board will meet in October 2019 for a full-day planning workshop. In advance of that meeting, the Board has committed to a strategic assessment of all of CSHP's programs and services, with 2 goals in mind: to inform the strategic planning process and to identify changes to programs and services that will strengthen CSHP as an organization.

The Internal Portfolio has also been busy. When we realized that we would not meet the membership targets set out in the current strategic plan, a working group of Board members, Branch presidents, and Membership Committee members was formed to develop recruitment and retention strategies. These strategies were approved by the Board in April 2018. Since then, the strategies have been prioritized, and additional working groups have been formed to develop implementation activities.

The future of the Professional Practice Conference has also undergone intense scrutiny by the Board, and a working group has been formed to identify how to revitalize the conference, now in its 50th year. Efforts are ongoing to evaluate all of CSHP's educational offerings, to discover the best ways to provide the high-quality education events that our members expect.

The awards program has also undergone a review, and changes have been recommended for both national and branch awards programs. The goal is to streamline awards offerings and avoid duplication.

As CSHP evaluates its programs and services, member input will be sought through various methods: surveys, polls, and social media. I encourage all members to make their views known when these opportunities arise.

I believe that exciting times are in store for CSHP, and I can't wait to see what lies ahead.

Patrick Fitch, BSP, ACPR, is Past President and Internal Liaison for the Canadian Society of Hospital Pharmacists.

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Participez aux Réseaux de spécialistes en pharmacie! Les membres de la SCPH vous mettent en contact avec ce qui est important : des gens et de l'information.

Les RSP :

- mettent les membres en contact avec d'autres personnes qui ont une passion pour un aspect particulier de la profession de pharmacien
- facilitent le partage rapide d'idées, de développements, de méthodes, d'expériences, de connaissances pour améliorer la pratique
- favorisent la collaboration à des projets, à des recherches et à des programmes éducatifs pour répondre aux besoins des membres des RSP
- proposent des occasions supplémentaires aux membres d'agir à titre de leaders d'opinion et de ressources clés pour le Conseil de la SCPH sur des questions de pratique spécialisée, dont la rédaction de déclarations de principes, de lignes directrices et des documents d'information pertinents

La participation aux RSP est gratuite pour les membres de la SCPH.

Visitez **MY.CSHP.ca** et inscrivez-vous dès aujourd'hui!

Canadian Society of Hospital Pharmacists

Société canadienne des pharmaciens d'hôpitaux

SPECIAL INTEREST COMMUNITIES OF PRACTICE

Connecting pharmacists across Canada

FOR IMPROVED PATIENT CARE

PHARMACY SPECIALTY NETWORKS

NETWORK PSN communicate

CSHP has more than 20 PSNs to join! Check out www.cshp.ca for a complete list.

Join the Pharmacy Specialty Network! CSHP membership will connect you with what's important – people and information.

PSNs:

- connect members with others who share a passion for a particular facet of pharmacy practice
- facilitate the quick exchange of ideas, developments, methods, experiences, and knowledge to improve practice
- support collaboration on projects, research, and educational programs to address the needs of the members of a PSN
- provide additional opportunities for members to serve as both opinion leaders and key resources for the CSHP Board on professional specialty issues, including development of relevant position statements, guidelines, and information papers

Participation in PSNs is free of charge to CSHP members

Visit **MY.CSHP.ca** and sign up today!

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