Anticoagulation Interventions by Pharmacists in Acute Care

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ABSTRACT

Background: Clinical pharmacy key performance indicators (cpKPIs) relate to activities performed by pharmacists that have been shown to improve patient outcomes. Within Saskatchewan Health Authority (SHA) Regina, most cpKPIs are incorporated into the organization's clinical practice standards, which provide guidance in prioritizing care, especially for high-risk medications, including anticoagulants. To track pharmacists' interventions associated with clinical practice standards, a locally developed electronic data-capture system (known as AIM High) was implemented.

Objectives: To quantify and describe pharmacists' anticoagulation interventions on 16 wards with dedicated ward-based clinical pharmacists and to compare intervention rates between the cardiology and internal medicine wards to further evolve the organization's practice model.

Methods: Data from the electronic data-capture system were retrospectively analyzed for a 5-year period (January 2016 to December 2020).

Results: A total of 94 201 interventions were recorded in the AIM High system (average 362 interventions per week or 26 interventions per pharmacist per week). Of these, 15 661 (16.6%) cited the anticoagulation standard (average 60 anticoagulation interventions per week or 4 anticoagulant interventions per pharmacist per week). For the cardiology and internal medicine wards, 4183 of 11 888 (35.2%) and 9034 of 54 843 (16.5%) interventions cited the anticoagulation standard, respectively. The top 4 types of anticoagulation interventions were dose changed (n = 4372 or 27.9%), drug started or restarted (n = 3867 or 24.7%), patient education (n = 3094 or 19.8%), and drug discontinued (n = 2944 or 18.8%).

Conclusion: Dedicated ward-based clinical pharmacists were following clinical practice standards incorporating the majority of cpKPIs to complete anticoagulation interventions. The types of anticoagulation interventions evolved over time and were influenced by the patient population.

Keywords: anticoagulation, pharmacist interventions, clinical pharmacy, clinical pharmacy key performance indicators

RÉSUMÉ

Contexte : Les indicateurs clés de performance en pharmacie clinique (ICPEPC) se rapportent à des activités exécutées par des pharmaciens qui ont fait leurs preuves dans l'amélioration des résultats pour les patients. À la Saskatchewan Health Authority (SHA) Regina, la plupart des ICPEPC sont intégrés aux normes de pratique clinique de l'organisme. Celles-ci fournissent des conseils pour hiérarchiser les soins liés aux médicaments, en particulier ceux associés aux médicaments à haut risque, notamment les anticoagulants. Un système électronique de saisie de données développé localement, le « AIM High », a été mis en place afin de suivre les interventions des pharmaciens associées aux normes de pratique clinique.

Objectifs : Quantifier et décrire les interventions des pharmaciens en matière d'anticoagulation dans 16 services avec des pharmaciens cliniciens dédiés et comparer les taux d'intervention entre les services de cardiologie et de médecine interne en vue de faire évoluer davantage le modèle de pratique de l'organisation.

Méthodes : Les données du système électronique de saisie des données ont été analysées rétrospectivement sur une période de 5 ans (de janvier 2016 à décembre 2020).

Résultats : Au total, 94 201 interventions ont été enregistrées dans le système (moyenne de 362 interventions par semaine ou 26 interventions par pharmacien par semaine). Parmi celles-ci, 15 661 (16,6 %) citent la norme d'anticoagulation (moyenne de 60 interventions d'anticoagulation par semaine – soit 4 interventions d'anticoagulation par pharmacien par semaine). Pour les services de cardiologie et de médecine interne, 4183 (35,2%) des 11 888 et 9034 (16,5 %) des 54 843 interventions citent respectivement la norme d'anticoagulation. Les 4 principaux types d'interventions d'anticoagulation étaient le changement de dose (n = 4372 ou 27,9 %), le traitement commencé ou redémarré (n = 3867 ou 24,7 %), l'éducation du patient (n = 3094 ou 19,8 %) et l'arrêt du médicament (n = 2944 ou 18,8 %).

Conclusion : Les pharmaciens cliniques dédiés au service suivaient les normes de pratique clinique incorporant la majorité des ICPEPC pour mener à bien les interventions d'anticoagulation. Les types d'interventions d'anticoagulation ont évolué au fil du temps et ont été influencés par la population de patients.

Mots-clés : anticoagulation, interventions du pharmacien, pharmacie clinique, indicateurs clés de performance de la pharmacie clinique

INTRODUCTION

Hospital pharmacists strive to provide high-quality pharmaceutical care, and clinical pharmacy key performance indicators (cpKPIs) can be used to quantify the quality of care.[1] The cpKPIs are 8 activities that, when performed by pharmacists, have been demonstrated to improve patient outcomes by decreasing morbidity and hospital readmissions.[2] These activities include medication reconciliation, patient education, attendance at interprofessional rounds, and resolution of drug therapy problems.[2]

The cpKPIs can be used to guide pharmacists in prioritizing care activities, elevate professional accountability by informing patients and their care team about activities that pharmacists will reliably perform, and permit benchmarking within and between organizations.[2] Within Saskatchewan Health Authority (SHA) Regina, not all 8 cpKPIs are routinely captured, but the majority of cpKPIs have been operationalized into clinical practice standards that guide patient care expectations. The local practice model includes dedicated ward-based clinical pharmacists providing interdisciplinary care, with an average patient to pharmacist ratio of 30:1, and dispensary-based patient care, provided by centralized pharmacists working primarily in the main pharmacy department, with higher patient to pharmacist ratios. Clinical practice standards used by the dedicated ward-based clinical pharmacists target prevalent disease states requiring complex regimens and high-risk medications, including antimicrobials, heart failure medications, and anticoagulants.

Anticoagulants are deemed to be high-alert medications because of their risk of causing significant harm when used in error.[3] In 2016, harm from oral anticoagulants ranked as one of the highest-priority drug safety problems, and anticoagulants were shown to account for 14.9% of all emergency room visits for adverse drug events, more than any other class of medication.[4,5] Previous studies showed that the most common anticoagulation-related events included not starting drugs, inappropriate drug choice, and use of wrong strength,[6] and patients exposed to incorrect anticoagulation dosing had double the risk of bleeding.[7]

As pharmacists routinely focus on optimizing medication therapy, involvement of a pharmacist may improve anticoagulant-related outcomes. In 2014, pharmacists in Regina collaborated with physicians and allied health providers to develop the anticoagulation clinical practice standard for use in the Regina area, which outlines activities intended to improve the use of anticoagulants (Appendix 1, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/214). SHA Regina continues to assess both the practice model and the various clinical practice standards as we strive to consistently improve the care provided by pharmacists.

In 2015, an electronic, stand-alone data-capture system (AIM High) was developed and implemented in SHA Regina utilizing Google Forms, as a means to collect completed pharmacist interventions. Within this system, pharmacists self-report and manually input their interventions daily, including the specific intervention performed, the clinical practice standard followed, the time of day, the location, and whether documentation was completed in the patient's medical record (Appendix 2, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/214). AIM High, the data-capture tool, has not been tested by a third party but has been modified on the basis of feedback from end-users, and version 2 is currently in use (AIM High [version 2])

The primary objective of this study was to quantify pharmacist interventions that followed the anticoagulation clinical practice standard for adult inpatients on all wards with dedicated ward-based clinical pharmacists. We further sought to determine if the frequency and types of anticoagulation interventions performed were similar or different in the subgroups of cardiology and internal medicine. The secondary objective was to describe the types of pharmacist anticoagulation interventions occurring on these wards.

METHODS

A retrospective analysis of 5 years of data (January 2016 to December 2020) from the AIM High system was performed using Microsoft Excel (version 14.0); the timeframe was chosen to include all data since the inception of the AIM High system. The data were reported using a descriptive analysis of counts and proportions. Ethics approval and consent were not obtained because of the quality improvement nature of this project; also, the AIM High system reports only aggregated, de-identified information. The data analyzed described interventions completed for adult patients on 16 wards with dedicated clinical pharmacists (including 3 cardiology wards and 6 internal medicine wards; the remaining 7 wards were for critical care, general surgery, palliative care, and oncology populations) at the Regina General Hospital (a 437-bed tertiary care hospital) and the Pasqua Hospital (a 250-bed tertiary care hospital) during clinically staffed hours in Regina, Saskatchewan. Care on these wards is provided by 14 dedicated clinical pharmacists from Monday to Friday, 0730 to 1600. Outpatients, pediatric patients, and patients on wards receiving services from centralized, dispensary-based pharmacists were excluded.

RESULTS

A total of 94 201 pharmacist interventions were recorded over 5 years, equivalent to an average of 362 interventions per week (or about 26 interventions per pharmacist per week). Interventions related to the anticoagulation clinical practice standard accounted for 16.6% (n = 15 661) of these interventions, for an average of 60 interventions per week (or

about 4 interventions per pharmacist per week) (Table 1). The number of anticoagulation interventions remained largely consistent at about 3000 interventions per year over the period of analysis. With further categorization, anticoagulation interventions accounted for 35.2% (n = 4183) of all interventions on the 3 cardiology wards and 16.5% (n = 9034) of all interventions on the 6 internal medicine wards.

Pharmacists' anticoagulation interventions included changing the dose (27.9%; n = 4372), starting or restarting a drug (24.7%; n = 3867), providing patient education (19.8%, n = 3094), and discontinuing a drug (18.8%, n = 2944). On cardiology wards, pharmacists most commonly provided patient education (39.5% of anticoagulation interventions), whereas on internal medicine wards, pharmacists most commonly changed doses (30.3% of anticoagulation interventions). Figure 1 indicates a shift in interventions over time, with declines in the proportions of education and re-initiation interventions and an increase in the proportion of interventions that involved discontinuing medications. Examination of the data specific to anticoagulation interventions on the cardiology and internal medicine wards showed that patient education interventions decreased both numerically and proportionally.

DISCUSSION

Within SHA Regina, pharmacists performed anticoagulation interventions 15 661 times over 5 years, accounting for approximately 1 in 6 of all pharmacist interventions (average of 60 times per week or 4 interventions per pharmacist per week). The main types of interventions were resolving drug therapy problems and providing patient education, which also correlate with 2 of the 8 cpKPIs. Our aim was to use these pharmacist intervention data to describe current practice and then, as part of the evolution of our clinical practice model, to develop a quality improvement strategy in patient

TABLE 1. Frequency of Interventions for Adult Inpatients, Performed by Pharmacists in Accordance with Clinical Practice Standards

	Year; No. (%) of Interventions					
Intervention[a]	**All Years**	**2016**	**2017**	**2018**	**2019**	**2020**
Wards with dedicated ward-based clinical pharmacists (n = 16)						
All interventions	94 201	15 742	15 074	16 995	22 847	23 543
Drug discontinued	26 763 (28.4)	4 820 (30.6)	4 401 (29.2)	4 752 (28.0)	6 333 (27.7)	6 457 (27.4)
Drug started/restarted	26 019 (27.6)	4 045 (25.7)	4 274 (28.4)	4 999 (29.4)	6 242 (27.3)	6 459 (27.4)
Dose changed (including interval)	20 103 (21.3)	3 064 (19.5)	2 922 (19.4)	3 505 (20.6)	5 433 (23.8)	5 179 (22.0)
Patient education	7 110 (7.5)	1 467 (9.3)	1 315 (8.7)	1 279 (7.5)	1 521 (6.7)	1 528 (6.5)
Anticoagulation interventions	15 661 (16.6)[b]	3 240 (20.6)[b]	3 159 (21.0)[b]	2 890 (17.0)[b]	3 265 (14.3)[b]	3 107 (13.2)[b]
Drug discontinued	2 944 (18.8)	567 (17.5)	576 (18.2)	551 (19.1)	633 (19.4)	617 (19.9)
Drug started/restarted	3 867 (24.7)	827 (25.5)	829 (26.2)	763 (26.4)	746 (22.8)	702 (22.6)
Dose changed (including interval)	4 372 (27.9)	823 (25.4)	795 (25.2)	836 (28.9)	1 034 (31.7)	884 (28.5)
Patient education	3 094 (19.8)	759 (23.4)	717 (22.7)	520 (18.0)	565 (17.3)	533 (17.2)
Cardiology wards (n = 3)						
All interventions	11 888	2 531	2 217	2 090	2 397	2 653
Anticoagulation interventions	4 183 (35.2)[c]	1 060 (41.9)[c]	950 (42.9)[c]	758 (36.3)[c]	724 (30.2)[c]	691 (26.0)[c]
Drug discontinued	689 (16.5)	172 (16.2)	165 (17.4)	138 (18.2)	130 (18.0)	84 (12.2)
Drug started/restarted	802 (19.2)	201 (19.0)	163 (17.2)	161 (21.2)	125 (17.3)	152 (22.0)
Dose changed (including interval)	742 (17.7)	152 (14.3)	154 (16.2)	132 (17.4)	166 (22.9)	138 (20.0)
Patient education	1 652 (39.5)	468 (44.2)	404 (42.5)	291 (38.4)	244 (33.7)	245 (35.5)
Internal medicine wards (n = 6)						
All interventions	54 843	6 653	7 612	10 369	15 059	15 150
Anticoagulation interventions	9 034 (16.5)[d]	1 693 (25.4)[d]	1 783 (23.4)[d]	1 593 (15.4)[d]	2 008 (13.3)[d]	1 957 (12.9)[d]
Drug discontinued	1 924 (21.3)	319 (18.8)	343 (19.2)	356 (22.3)	428 (21.3)	478 (24.4)
Drug started/restarted	2 310 (25.6)	447 (26.4)	532 (29.8)	430 (27.0)	469 (23.4)	432 (22.1)
Dose changed (including interval)	2 736 (30.3)	513 (30.3)	497 (27.9)	487 (30.6)	662 (33.0)	577 (29.5)
Patient education	1 283 (14.2)	260 (15.4)	274 (15.4)	205 (12.9)	275 (13.7)	269 (13.7)

[a]Subentries in this column represent only the 4 most common types of pharmacist interventions, not an inclusive list of all pharmacist interventions completed.
[b]Percentages for anticoagulation interventions are relative to all interventions on wards with dedicated ward-based clinical pharmacists
[c]Percentages for anticoagulation interventions are relative to all interventions on cardiology wards.
[d]Percentages for anticoagulation interventions are relative to all interventions on internal medicine wards.

care by ensuring that pharmacists focus on cpKPI-related activities. National registry data for cpKPIs are being collected in hospitals across Canada, but to date, few of these data (if any) have been published, and a Canadian benchmark has not been established.[8] Similarly, existing studies have measured different activities completed by pharmacists, and we found no consensus on productivity measures for pharmacists in the literature.

The number of anticoagulation interventions on wards with dedicated ward-based clinical pharmacists remained consistent over time in our practice setting; however, the proportion of anticoagulation interventions relative to total interventions is decreasing, which suggests an evolution toward a broader range of clinical pharmacist interventions in SHA Regina. One possible explanation for the proportional decline in anticoagulation interventions is that prescribers may be adapting their prescribing habits after collaborating with pharmacists to rectify incorrect anticoagulation orders. In such a situation, a pharmacist may interact with a prescriber only once, but the impact of that interaction on patient care may be repeated multiple times and thus is difficult to quantify.[9] Another possible explanation is the continued growth of prescribing supports such as standardized order sets.[10]

Pharmacists on cardiology wards completed a higher proportion of anticoagulation interventions than those on internal medicine wards, which highlights heterogeneity in patients' demographic characteristics and diagnoses, as well as variation in use of the anticoagulation clinical practice standard. For example, patients on cardiology wards frequently have more indications for treatment doses of anticoagulants, as well as indications for antiplatelet agents, than patients on internal medicine wards, who may receive prophylactic doses of anticoagulants to prevent venous thromboembolism. Thus, pharmacists practising in different specialities have different opportunities for interventions.

In 2018, additional funding was obtained to improve patient to pharmacist ratios for clinically staffed hours through development of an "Accountable Care Unit" philosophy, which was instituted on 3 internal medicine wards (change in patient to pharmacist ratio from 30:1 to about 17:1). As a result, pharmacist interventions increased overall, and clinical services expanded beyond the high-priority clinical practice standards such as anticoagulation. Extrapolating the findings from this experience, we anticipate that improving patient to pharmacist ratios across all wards with dedicated ward-based clinical pharmacists could increase medication optimization and improve quality of care.

In terms of the types of anticoagulation interventions performed by pharmacists, the proportions of interventions related to patient education and restarting medications are declining while the proportion related to discontinuing medications is increasing. This may be explained by departmental prioritization of optimizing medications before discharge and relying on our well-positioned community pharmacy colleagues to provide education once patients' medication therapy has been optimized.[11,12]

The Canadian Cardiovascular Society Atrial Fibrillation Guidelines 2010 recommended a transition in practice from warfarin to direct oral anticoagulants (DOACs) as preferred first-line therapy,[13] which may have affected pharmacists' anticoagulant interventions during the study period. However, given that the AIM High system was

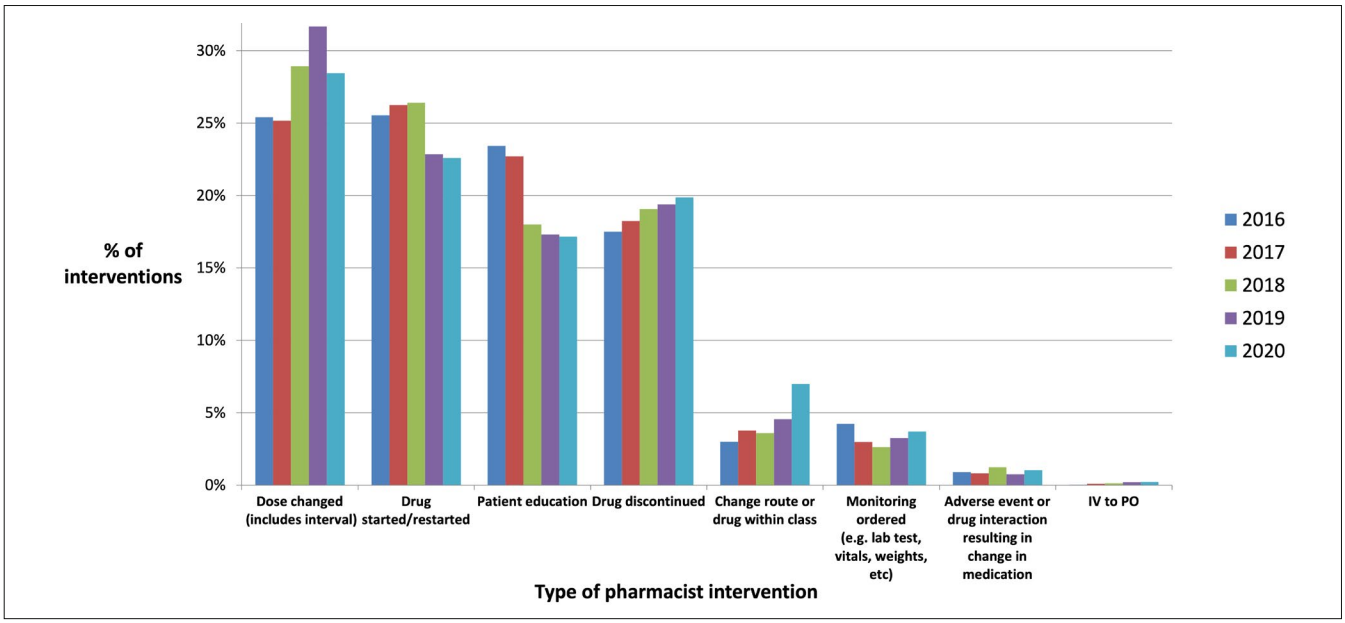

FIGURE 1. Types of interventions (and their frequency) performed by dedicated ward-based clinical pharmacists, according to the anticoagulation clinical practice standard.

implemented in 2015 and DOACs have been the standard of care in Regina (according to the anticoagulant clinical practice standard) since 2014, the effect of the 2010 guidelines on local data is thought to be minimal. Also, no collaborative prescribing agreement existed for pharmacists to independently manage inpatients' warfarin therapy in Regina. Therefore, pharmacists likely intervened similarly on both warfarin and DOAC therapy.

This study provides a unique description of pharmacist interventions with respect to anticoagulation and is strengthened by the collection and presentation of several years of cumulative data. Limitations include dependence on pharmacists self-reporting interventions into the AIM High system and the variability in reporting among the pharmacists, which may have led to misrepresentation of the actual numbers and types of interventions. The AIM High system quantifies only the number of interventions accepted, not the number recommended. The COVID-19 pandemic that began in 2020 may have had a multifaceted impact, with pharmacists having only limited contact with isolated patients and workload increasing because of higher patient loads and changing demographic characteristics.

CONCLUSION

Over the study period, dedicated ward-based clinical pharmacists were following clinical practice standards that incorporate the majority of cpKPIs to complete anticoagulation interventions. The types of anticoagulation interventions evolved over time and were influenced by patient population.

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