Canadian Society of Hospital Pharmacists

Société canadienne des pharmaciens d'hôpitaux

Hospital Pharmacy in Canada Report 2016/17

Hospital Pharmacy in Canada Survey Board

AstraZeneca Lilly Pfizer

Canadian Society of Hospital Pharmacists

Société canadienne des pharmaciens d'hôpitaux

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The current and past editions of the Hospital Pharmacy in Canada Report can be obtained from:

www.hospitalpharmacysurvey.ca

The Hospital Pharmacy in Canada Survey is conducted at approximately 2-year intervals. Suggestions for the next iteration of the Survey are welcomed.

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Contents

Hospital Pharmacy in Canada Report 2016/17

Click on the red bullets below or open and click on PDF bookmarks to navigate

Acknowledgements

Hospital Pharmacy in Canada Report 2016/17

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The Survey Board wishes to acknowledge and thank the support team of the Hospital Pharmacy in Canada Report 2016/17.

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The Survey Board would also like to thank the staff of hospital pharmacy departments across Canada who assembled data from their respective institutions and committed the time to complete the survey.

The Survey Board thanks the Canadian Society of Hospital Pharmacists, its Board, and its staff for their support of this survey.

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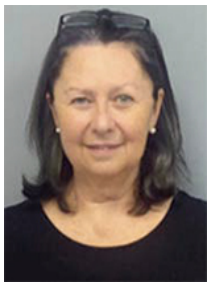

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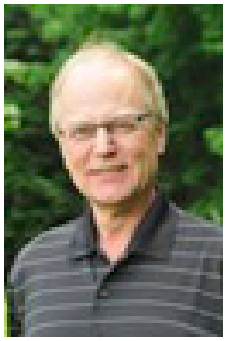

Forewords

Myrella Roy

Canadian Society of Hospital Pharmacists / Société canadienne des pharmaciens d'hôpitaux

On behalf of the Board of the Canadian Society of Hospital Pharmacists (CSHP), I am truly delighted to present to you the momentous 2016/17 edition of the Hospital Pharmacy in Canada Report. Over the lifetime of this publication, which first appeared in 1986, most readers have likely assumed that it belonged to the Society—quite an honest mistake, given that, all along, the survey has been designed and the associated report written and edited by esteemed CSHP members. As a matter of fact, though, the Society is publishing the report for the very first time.

Thanks to the generous sole sponsorship of Eli Lilly Canada for more than 30 years, the Hospital Pharmacy in Canada Report has become a leading reference and benchmarking tool for hospital pharmacy services across Canada and around the world. In 2017, the CSHP Board accepted the request of the Hospital Pharmacy in Canada Editorial Board to become one of the Society's affiliated boards. The CSHP Hospital Pharmacy in Canada Survey Board, as it is now known, conducted its 2016/17 survey within the CSHP fold, with sponsorship from AstraZeneca Canada, Eli Lilly Canada, and Pfizer Canada.

I am certain that, once again, the Hospital Pharmacy in Canada Report will prove to be a treasure trove of data on clinical pharmacy practice, pharmacy technician practice, pharmacy human resources, drug distribution systems, and technology, as well as a source of workload and resource benchmarks. I wish to thank the Hospital Pharmacy in Canada Survey Board and its support team for pulling off the monumental task of conducting this latest edition of the survey and publishing the report in Canada's two official languages.

May the Hospital Pharmacy in Canada Survey and Report, under the auspices of CSHP, live invaluably ever after!

Myrella Roy
Executive Director
Canadian Society of Hospital Pharmacists

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recognition reconnaissance best practices advocacy meilleures pratiques networking valorisation research recherche réseautage education formation

Forewords

Jamie Freedman

We are pleased to support this 21st edition of the Hospital Pharmacy in Canada Report. At AstraZeneca, we recognize the critical role that hospital pharmacists play in helping patients manage medications and improving health outcomes.

Together, we share a common goal with pharmacists, which is to improve patients' lives through creative solutions that help prevent and treat diseases. This survey is an important tool that enables Canadian hospital pharmacists and leaders to effectively share their insights with an aim to further that goal. Thank you for the opportunity to support this important research.

Jamie Freedman
President
AstraZeneca Canada

Forewords

Lauren Fisher

Eli Lilly Canada is proud to continue our support for the Hospital Pharmacy in Canada Report. First published in 1986, the 2016/17 report is the 21st edition, and falls for the first time under the umbrella of the Canadian Society of Hospital Pharmacists. Eli Lilly is pleased to welcome two new co-sponsors for 2016/17, AstraZeneca Canada and Pfizer Canada.

The participation of 180 hospital pharmacy departments from across Canada, who responded to the 2016/17 survey, represents a phenomenal response rate of 83%, a testimony to the importance and value of this national initiative.

This survey report continues to provide reliable clinical and management information for pharmacy and hospital administrators to use in identifying baseline, benchmarking current and planning enhanced pharmacy services.

We are confident that the information in the 2016/17 Hospital Pharmacy in Canada Report will assist your decision making in responding to the needs of your organizations.

Lauren Fischer
Vice President, Corporate Affairs
Eli Lilly Canada Inc.

The Survey Board's comments are based on an analysis of this data. The views expressed in the text do not necessarily represent those of Eli Lilly Canada Inc.

Forewords

Aidan Griffin

Pfizer Canada is pleased to add our support to this 21st edition of the Hospital Pharmacy in Canada Report. This report is an important vehicle for Canadian hospital pharmacy leaders to share information on clinical and administrative practices within their institutions. This sharing helps to promote the advancement of the hospital pharmacy profession through identification and promotion of best practices. The participation of 180 hospital pharmacy departments across Canada, which responded to the 2016/17 Hospital Pharmacy in Canada Survey, provides testimony to the quality and value of this initiative.

Pfizer Canada is delighted to have the opportunity to contribute to this valuable national effort.

Aidan Griffin
Business Unit Director, Pfizer Injectables
Pfizer Canada Inc.

Introduction

Richard Jones

The hospital Pharmacy in Canada Report for 2016/17 is the 21st edition of this national report. With the current edition, this publication has undergone several changes, principally in terms of support and administration for both the report and the survey on which it is based. Working closely with the Canadian Society of Hospital Pharmacists (CSHP), specifically Executive Director Myrella Roy and members of the CSHP Executive Committee, and with the guidance of Andrew Merrick of Eli Lilly Canada, the renamed Hospital Pharmacy in Canada Survey Board now proudly operates as an Affiliated Board of CSHP. AstraZeneca Canada, Eli Lilly Canada and Pfizer Canada have come together to support this edition, setting the stage for a strong future for both the survey and the report.

The 2016/17 report is the culmination of extensive analysis of data gathered in spring 2017 via an online survey of directors of hospital pharmacy across Canada. A total of 184 respondents from 223 eligible organizations completed the survey, for an 83% response rate.

Previous editions of this report have used the definition of a teaching hospital set forth by the Association of Canadian Academic Health Care Organizations (ACAHCO). However, the definition of a teaching hospital has become less clear with the replacement of ACAHCO by a new organization, HealthCareCAN, which does not specifically define academic facilities. For the purposes of the 2016/17 report, we used the previous ACAHCO definition to identify academic facilities, thereby enabling comparability with previous reports. In the 2016/17 report, pediatric hospitals are not discussed within a dedicated chapter (as was the case in the two previous reports). Instead, data for the seven pediatric hospitals that responded to the survey are presented in the chapter tables as a separate column, alongside data for teaching and non-teaching facilities.

Chapter A, Demographics, provides an overview of participating facilities from across Canada. As in recent reports, data from certain pairs of jurisdictions are combined: Newfoundland and Labrador with Nova Scotia, Prince Edward Island with New Brunswick and the Yukon with British Columbia. There were no respondents from the Northwest Territories in 2016/17. Where results are reported on a regional basis, BC and Yukon are again combined, Prairie Provinces consist of Alberta, Saskatchewan and Manitoba, and the Atlantic Provinces combine Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland and Labrador.

Chapter B, Clinical Pharmacy Practice, by Jean-François Bussières and Debra Merrill, highlights research demonstrating that comprehensive medication management, performed by a pharmacist in collaborative practice, is a successful approach to patient care. The authors also compare Canadian clinical pharmacist services with those in the United States, where the American College of Clinical Pharmacy is leading the process to re-assess the value that clinical pharmacists bring to patient care. The chapter authors also review the current status of pharmacist roles in ambulatory and inpatient care settings, including the range of services provided. An update on the status of the Canadian clinical pharmacy key performance indicators is included in this chapter.

In Chapter C, Kyle MacNair and Allan Mills review several aspects of drug distribution systems. Data are presented on the expanded implementation of unit-dose systems, changes in the level of decentralized services and the deployment of technologies such as automated dispensing cabinets on patient care units. This chapter also highlights some changes since the last report in medication order entry, checking and verification by pharmacists.

Chapter D focuses on human resources. In this chapter, André Bonnici analyzes vacancy rates for both pharmacists and regulated pharmacy technicians. He also presents new information on the ratio of pharmacists to regulated technicians for various organization types. André also notes some substantial differences in compensation among provinces.

In Chapter E, Benchmarking, Jean-François Bussières and Douglas Doucette report the results of a new resource matrix for gathering benchmark data (see methodology chapter). The matrix was developed in an attempt to generate more detailed information concerning how organizations allocate both dollars and staff (specifically pharmacists and regulated technicians) to various services.

Douglas Doucette presents an update on regulated and non-regulated pharmacy technicians in Chapter F. Trends in specific functions performed by pharmacy technicians and their roles in direct patient care activities are presented. Doug also reviews how job descriptions have evolved for technical staff in the context of pharmacy

technician regulation in the various provinces. Non-regulated pharmacy technicians, also known as pharmacy assistants, continue to play a role in many hospital pharmacies.

The final chapter, by Allan Mills, reviews changes in the use of technology in Canadian hospitals. Examples include the extent of adoption of TALLman lettering in electronic systems, the implementation of computerized practitioner order entry (CPOE) systems and confirmation that pharmacists are no longer accessing laboratory data through paper-based systems. Allan examines the expansion of smart pump deployment, noting that wireless updating of pump data is becoming standard practice. By contrast, although barcoding is a unifying and quality driver of medication system safety, its implementation remains limited.

The Hospital Pharmacy in Canada Survey Board wishes to recognize our sponsors and the support they have provided during our transition to becoming a CSHP Affiliated Board. George DeAngelis served as AstraZeneca Canada's first representative to the Board, and we are pleased to now welcome Rita Egan in this role. Eli Lilly Canada continues to be capably represented by Andrew Merrick. Andrew has worked with the Board for many years, and his guidance and support with the transition are greatly appreciated. Finally, we welcome Aidan Griffin as the representative for Pfizer Canada. Aidan is well known and respected by his peers in hospital pharmacy across Canada.

The contributions of certain other members of the Board deserve recognition here. Emily Musing has served on the Board for 8 years, first, for 2 years as the CSHP 2015 guest editor for the 2007/08 report and then for an additional 6 years (from 2009 to 2015) as Executive Editor. Emily was instrumental in facilitating transition of this endeavour to CSHP, and her efforts have allowed the Board to continue to produce a nationally and internationally recognized report. Allan Mills and Debra Merrill have recently joined the Board as Editors for Ontario. Finally, after 6 years as the CSHP 2015 guest editor, Carolyn Dittmar is now a Managing Editor, serving in this role with Chuck Wilgosh.

With this report, we bid farewell to three amazing individuals who, for many years, have played significant roles in production of the reports. We wish to acknowledge and pay tribute to Managing Editor Chuck Wilgosh, Research Analyst Paul Oeltjen and Executive Assistant Marjorie Robertson. The Board is truly grateful for their many years of service and their important contributions to the national fabric of hospital pharmacy. In addition, Website Manager George Horne will be retiring once the current report has been migrated to a new web platform.

With the release of the 2016/17 report, the transition to CSHP and the appointment of our new Board members, we hope that the Hospital Pharmacy in Canada project will continue to empower and inform hospital pharmacy leaders as they provide leadership in their respective organizations. On behalf of the Board, I now tender this report to the Canadian hospital pharmacy community. We hope it will prove useful as hospital pharmacy continues to grow and evolve, while providing the highest-quality comprehensive medication management for all patients receiving care in Canadian healthcare institutions.

Richard Jones
Executive Editor

Data Collection Methodology

Paul Oeltjen

An initial list of Canadian hospital pharmacies was prepared, based on respondents to previous surveys, hospital pharmacies identified by members of the Hospital Pharmacy in Canada Survey Board, and hospital pharmacies on the mailing list of the Hospital Pharmacy in Canada Survey Board. The members of the Board (listed on page v of this report and referred to hereafter as "the Editors") were responsible for verifying the current name and email address of the director of pharmacy and the hospital's chief executive officer (CEO) for each hospital pharmacy on the list from the province(s) that they represented. At that point, the facilities were classified by hospital type (teaching or non-teaching) and each hospital's eligibility to participate in the survey was determined, according to the qualifying criterion of 50 or more acute care beds. Based on the information collected at this stage, and after deletion of redundant contact information, the list consisted of 223 hospitals.

The 2016/17 Hospital Pharmacy in Canada Survey was announced in email messages sent to directors of pharmacy (on May 15, 2017) and CEOs (on May 29, 2017) of the initial selection of hospitals. Because some of the data required to complete the survey had to be obtained from other departments within each facility, a second email message was sent to the directors of pharmacy on May 19, 2017, containing a summary of the data elements that the pharmacy department would likely need to obtain from other departments within the organization. A third email message was sent only to the directors of pharmacy during the period from May 27 to May 31, 2017. This message contained a hospital-specific identification code and password required to log on to the survey website. Regional directors of pharmacy, where applicable, were informed of the ongoing survey and were asked for their support on May 30, 2018.

During the subsequent weeks, the Editors followed up with potential respondents to ensure that the identification codes and passwords had been received and to encourage participation. If required, email messages with access information were re-sent to directors who had difficulties locating the messages sent in May. On June 10, June 23, July 6 and July 11, reminder notices were sent by email to directors of pharmacy who had not yet completed the online survey, asking them to participate. In addition, in early July, the Editors personally contacted hospital pharmacies that had not yet responded, explaining the importance of participation in this national survey.

The identification code and password enabled the respondent representing each facility to log on to the survey website at any time to complete any part of the questionnaire (in English or in French); the respondent could use as many sessions as desired to complete the survey. The first page of the website contained instructions for completing the survey and a link for downloading a pdf version of the survey questionnaire. This pdf document (also available in English or in French) was 43 pages long. On the website, the survey questions were distributed over eight web pages corresponding to the eight sections of the questionnaire. From any questionnaire web page, a respondent could return to the instruction page or move to any other page of the online survey. Each section of the survey opened with a list of definitions of terms used in the questions in the section. These definitions also popped up when the cursor was positioned over the first occurrence of each defined term in that section of the questionnaire.

Completion of the online survey was interactive: if follow-up questions were applicable because of the answer given on a screening question, a modified version of the questionnaire web page was presented which included these additional questions. After a respondent had saved responses for the current page, the program warned of any instances where non-numeric information had been entered in fields that required numeric answers. To avoid problems resulting from inconsistent use of periods or commas for decimal indicators, the system forced users to enter numeric information requiring a decimal place in two separate fields, one for the whole-number part of the value and the other for the decimal part.

The 2016/17 survey introduced a new element, the Benchmarking Resource Matrix. This matrix was a spreadsheet to support the reporting of financial and workload information for use in generating benchmarking data and ratios. The matrix allowed each respondent to enter total workload and resource data for each of 13 pharmacy service areas (programs). Workload and resource data consisted of five workload indicators, nine inpatient resource indicators and nine outpatient resource indicators. Respondents were asked to download the spreadsheet from the survey website, complete the matrix on the local computer system and then upload the completed spreadsheet to the survey website. The deadline for completing the survey was July 16, and most facilities were able to meet this deadline. In a few cases a brief extension was granted to complete the online survey or to submit the Benchmarking Resource Matrix.
On August 13, the survey website was closed for participation. At that time, representatives from a total of **184 hospitals** had logged on, confirmed the number of acute care beds as 50 or more, and entered responses to six or more sections of the survey questionnaire. Using as a base the 223 potentially qualified hospitals that were invited to

participate, the response rate was therefore 83%. The actual response rate may have been higher, because it is possible that hospitals that never logged on to the survey website or that did not answer any questions had fewer than 50 acute care beds, in which case they would not have been qualified to participate in the survey and the overall number of eligible facilities would have been smaller.

The Editors confirmed the initial classification of hospitals as teaching hospitals, non-teaching hospitals and pediatric hospitals. Although all of the pediatric hospitals were also teaching hospitals, they were excluded from the teaching hospital category, to ensure exclusive categories for use as headings in the summary tables of survey results.
After the survey website was closed, a new site was created for the exclusive use of the two Managing Editors, who each selected for review half of the responding hospitals. For each respondent, the Managing Editor was presented with a summary page showing 15 different ratios (e.g., calculated occupancy rate for acute care beds, budgeted inpatient hours per acute care inpatient day, total technician + assistant full-time equivalent [FTE] per total pharmacist FTE, pharmacist vacancy rate [as a percentage]). If any of these ratios looked questionable, the Managing Editor contacted the responding hospital for an explanation or excluded the corresponding answers from the analysis. The Managing Editor then proceeded to review data for all sections of the questionnaire, looking for inconsistencies, obviously incorrect entries of numeric data or questionable data. After completion of this review, the data were downloaded from the website, and results were tabulated by the team's research analyst who prepared summary tables for all variables captured by the online survey. For categorical variables these summary tables included the total number of respondents who answered the corresponding question and the percentage of respondents who checked each alternative. Summary tables for numeric variables included the number of respondents who provided the requested data and the mean and standard deviation as well as the median and the lowest and highest value. In addition to the overall results, results were also tabulated for three banner variables: Bed Size (50 – 200, 201- 500, and >500), Hospital Type (Teaching [excluding pediatric] hospitals], Non-teaching hospitals, Pediatric hospitals), Region (Western Provinces [BC,YT], Prairie Provinces [AB,MB,SK], Ontario, Quebec, Atlantic Provinces [NS, NB, PE, NL]) or for Province (BC/YT, AB, SK, MB, ON, QC, NB/ PE, NS/ NL). These summary tables were uploaded to a website where editors could download each summary table for use in writing their chapter.

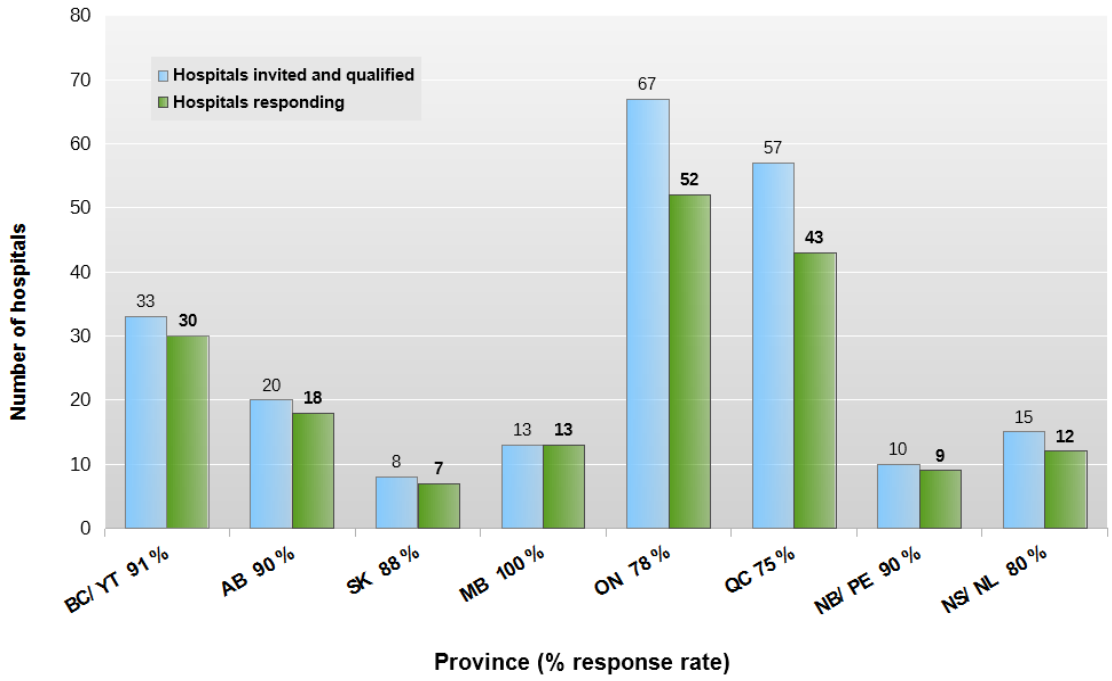
A - Demographics

Richard Jones

The Canadian Institute for Health Information (CIHI) recently reported that Canada had 596 hospitals (ranging from acute to long-term care) in 2015-2016.[1] Of these, 223 had 50 or more staffed acute care beds, making them eligible to respond to the 2016/17 Hospital Pharmacy in Canada Survey. The response rate for this edition of the survey was 83% (184/223), which represents an increase from 78% (170/217) for the 2013/14 survey. Provincial response rates were similar to those for the 2013/14 survey, with increases seen for Alberta from 82% (14/17) to 90% (18/20); Ontario (ON), from 69% (44/64) to 78% (52/67); and Nova Scotia/Newfoundland and Labrador, from 67% (10/15) to 80% (12/15) (Figure A-1).

In terms of bed size, the number of responding hospitals with more than 500 beds increased from 45 in 2013/14 to 53 in 2016/17 (Table A-1). The number of teaching hospitals that responded to the survey was similar at 41 (vs. 42 in 2013/14); however, there were more responses from non-teaching hospitals (136 in 2016/17 vs. 128 in 2013/14). In the current survey, teaching hospitals accounted for 21,883 acute care beds and non-teaching hospitals for 31,077 acute care beds. Also included in this survey are data from 7 pediatric hospitals, accounting for 1,515 acute care beds. All of these are teaching hospitals, but they are analyzed separately in this report. Teaching hospitals accounted for a notably lower number of non-acute care beds than non-teaching hospitals (3,790 vs. 23,474).

Figure A-1. Response to the Survey by Province, 2016/17



Note: Total number of respondents (including 7 pediatric hospitals) = 184 (83%, 184/223)

The average number of acute care beds (per respondent) was 296, the same as in 2013/14, whereas the average number of non-acute care beds increased, from 126 to 149. The total number of beds accounted for by hospitals responding to the survey was 81,803, of which 54,475 were acute care beds and 27,328 were non-acute care beds.

The proportion of respondents with combined survey responses for multiple sites was 27% (49/182).

Table A-1. Hospital Demographic Data – Acute and Non-Acute Care Beds, 2016/17

	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Hospitals (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Totals:												
Beds - acute care	**54,475**	**5,432**	**20,416**	**28,627**	**21,883**	**31,077**	**1,515**	**7,445**	**11,293**	**15,977**	**14,188**	**5,572**
Beds - non-acute care	**27,328**	**916**	**6,972**	**19,440**	**3,790**	**23,474**	**64**	**3,003**	**912**	**3,239**	**17,889**	**2,285**
Averages:												
Beds - acute care	**296**	**109**	**252**	**540**	**534**	**229**	**216**	**248**	**297**	**307**	**330**	**265**
Beds - non-acute care	**149**	**18**	**86**	**367**	**92**	**173**	**9**	**100**	**24**	**62**	**416**	**109**
Base: All respondents												
Note: The average of non-acute beds is based on all hospitals (including those with 0 non-acute beds)												
Occupancy Rate (acute) (n=)	(173)	(47)	(78)	(48)	(41)	(125)	(7)	(30)	(38)	(51)	(34)	(20)
	91%	**88%**	**92%**	**93%**	**93%**	**91%**	**82%**	**100%**	**91%**	**91%**	**85%**	**89%**
Base: Respondents who provided patient days												
Occupancy Rate (non-acute) (n=)	(91)	(13)	(45)	(33)	(14)	(75)	(2)	(13)	(11)	(30)	(24)	(13)
	90%	**94%**	**92%**	**87%**	**93%**	**90%**	**85%**	**86%**	**83%**	**96%**	**89%**	**88%**
Base: Respondents with > 20 non-acute beds who provided patient days												
Average length of inpatient (n=)	(168)	(46)	(76)	(46)	(39)	(123)	(6)	(28)	(38)	(48)	(34)	(20)
stay – acute care (days)	**7.2**	**6.7**	**7.0**	**8.1**	**7.8**	**7.1**	**5.2**	**9.1**	**7.8**	**5.5**	**6.8**	**8.2**
Base: All respondents												

The national average occupancy rate for acute care beds was 91%. British Columbia/Yukon had both the highest average acute care occupancy rate (100%) and the longest average length of stay (9.1 days). Quebec had the lowest average occupancy rate (85%), and ON had the shortest average length of stay (5.5 days). The national average length of stay was unchanged from the 2013/14 survey at 7.2 days (based on 168 respondents for 2016/17).

[1] CMDB hospital beds staffed and in operation 2015-2016. Ottawa (ON): Canadian Institute for Health Information; 2017 [cited 2017 Jun 8]. Available from: https://www.cihi.ca/en/access-data-reports/results?query=beds+staffed&Search+Submit=

B - Clinical Pharmacy Practice

Jean-François Bussières and Debra Merrill

It is not by chance that the chapter on clinical pharmacy is one of the first in this report. The pharmacist is the primary healthcare professional trained to ensure the most appropriate treatment of patients from a medication perspective and to monitor drug therapy. For these activities to be successful, the right mix of human, material and financial resources is required. Key technologies are also essential to ensure that the medication management loop is closed. Enabled by current trends (e.g., regulation of pharmacy technical staff, centralization of pharmaceutical production and use of robotic technologies), the essential roles of the pharmacist are to treat patients and provide pharmaceutical care adapted to varied inpatient and outpatient clienteles, to ensure the proper use of drug therapy and to regularly assess its benefits.

Since the 2013/14 Hospital Pharmacy in Canada Report was published, there have been a number of developments and publications relevant to the survey data that will be presented in this chapter.

In 2017, the American College of Clinical Pharmacy (ACCP) published clinical competency guidelines for pharmacists,[1] which define the clinical practice model for evaluating a clinical pharmacist's profile, as defined in the ACCP position statement on scope of practice.[2] In particular, the ACCP guidelines focus on a patient-centred approach to delivering comprehensive medication management with a team-based approach. They define the competencies toward which clinical pharmacist practitioners should strive: direct patient care, pharmacotherapy knowledge, systems-based care and population health, communication, professionalism and continuing professional development. These competencies were designed to align with the competencies for physicians, as defined by the Accreditation Council for Graduate Medical Education.

Along with the guidelines, the ACCP provided a self-assessment tool and a template to facilitate the evaluation of both clinical pharmacists and pharmacy residents.[3,4]

Traditionally, there has been the impression that non-adherence was the major factor contributing to treatment failure. However, in 2016, the ACCP submitted a briefing document[5] showing that non-adherence accounted for only about 15% of medication-related problems. In fact, 57% of such problems were due to inadequate therapy, an area that the clinical pharmacist is best trained to address. The ACCP paper focused on the clinical pharmacist and comprehensive medication management as means to improve patients' medication therapy.

In the past two to three years, a plethora of publications pertaining to clinical pharmacists have utilized the ACCP's position paper on the optimal use of emerging medicines[6] and the ACCP's white paper on natural health products.[7] Recommendations to align post-graduate year 2 (PGY2) residency-type training with Board of Pharmacy Specialties certification,[8] as well as current licensing requirements, have positioned the clinical pharmacist as a key player in team-based settings, although there still remains a gap in patients' access to pharmacists in the United States.[9] This gap indicates that considerable work is still needed to ensure recognition of the positive effect that clinical pharmacists can have on medication-related outcomes. Research on pharmacy activities, as described in the Pharmacy Practice Model Initiative on specialty pharmacy practice,[10] is also important; hence, the need for programs such as research fellowships to train independent clinical pharmacy scientists.[11]

To meet the increased requirement of incorporating research into practice, the ACCP will launch a new online journal in October 2018 (the Journal of the American College of Clinical Pharmacy or JACCP) targeting work related to the practice of clinical pharmacy.[12] In addition, a recent paper looked at the peer-reviewed literature exploring the importance of developing residency research and defining relevant strategies.[13]

Canadian pharmacists have not been as prolific as their US counterparts, nor has their research been as focused on comprehensive medication management, although additional guidance sources are available in this country, such as publications of Accreditation Canada[14] and position statements of the Canadian Pharmacists Association[15] and the Canadian Society of Hospital Pharmacists (CSHP).[16] In Quebec (QC), the Ministry of Health and Social Services has published a guide on pharmaceutical care in oncology[17] detailing the specifics of pharmaceutical care and pharmacy services as they pertain to the field of oncology. The Association des pharmaciens des établissements de santé du Québec has pre-published for consultation a white paper on pharmacy practice and clinical pharmacy services.[18] The importance of having governing bodies recognize the role of clinical pharmacists' abilities cannot be overstated.

In this chapter, we analyze survey data relating to the development of clinical pharmacy practice in Canadian hospitals, showing how far it has come and where it needs to go in the future.

Structured Patient Care Programs

The following definition of a "patient care program" has been included in the Hospital Pharmacy in Canada Survey since the 2007/08 iteration:

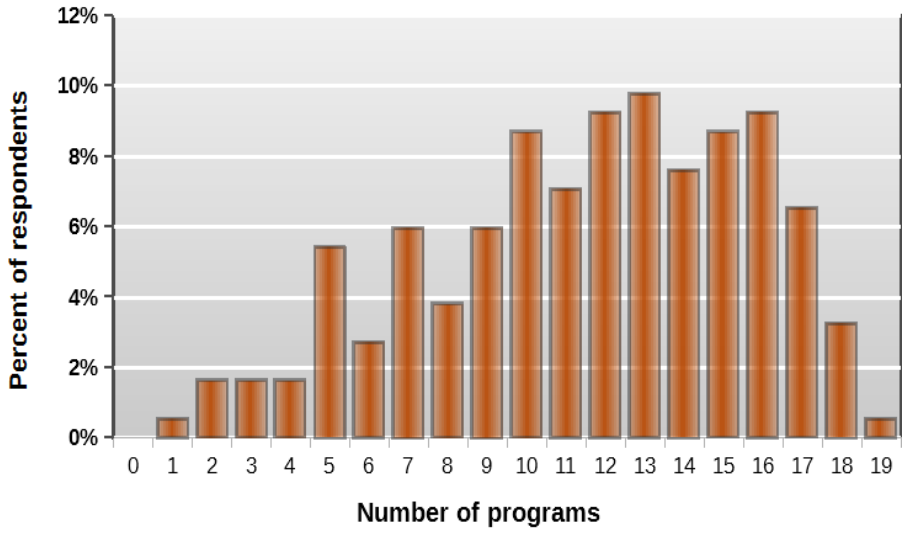
> *Healthcare delivery that is formally structured around a group of patients with similar healthcare needs (e.g., child health program, mental health program, critical care program). A formal patient care program will usually have a physician and/or nurse leader or director.*

Respondents to the 2016/17 survey were asked whether their facility had (or did not have) formal patient care programs for 19 specific patient groups. Respondents were also asked to identify the number and the nature of any newly supported patient care programs.

- Out of the 19 formal patient care programs listed in the survey, respondents nationally reported a facility average ± standard deviation of 11.5 ± 4.1 programs (range 1–19) (2013/14 data: 11.2 ± 4.3, range 0–19), with an average of 10.1 ± 5.0 programs in British Columbia/Yukon (BC/YT), 10.1 ± 4.6 programs in the Prairies, 12.9 ± 3.2 programs in Ontario (ON), 12.0 ± 3.7 programs in QC and 11.7 ± 3.8 programs in the Atlantic provinces. [The Prairies comprise Alberta (AB), Saskatchewan (SK) and Manitoba (MB). The Atlantic provinces comprise New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PE) and Newfoundland and Labrador (NL).]

- Figure B-1 summarizes the distribution of respondents who reported providing formal patient care programs in 2016/17, with 2% (4/184) reporting just one or two formal patient care programs, and none reporting no formal patient care programs (by comparison, 2% of respondents [4/163] reported no clinical programs in 2013/14).

Figure B-1. Respondents Providing Formal Patient Care Programs, 2016/17



Base: All respondents (n=184)

Respondents were also asked to indicate whether one or more designated pharmacists were assigned to these formal programs for inpatient and/or outpatient services, where a designated pharmacist was defined as a minimum of 0.2 full-time equivalent (FTE) pharmacist (whether this minimum was one day per week or two half-days per week). Formal assignment of a pharmacist to a patient care program is assumed to indicate that a reasonable level of clinical pharmacy support is being provided to that program.

Note: If a respondent identified and provided data for a specific clinical program that was not already listed in the survey questionnaire, those data were not incorporated into the data tables in any form and are not discussed here.

Profile of Outpatient Clinical Pharmacy Services

- In the 2016/17 survey, 83% (153/184) of respondents reported assignment of a designated pharmacist to at least 1 of the 17 outpatient practice areas included in the survey. This value is slightly higher than the 78% (127/163) reported for 2013/14, which suggests an increase in the assignment of clinical pharmacists in outpatient care programs. It is probable that pharmacists in some of the other hospitals (e.g., smaller facilities) are providing clinical pharmacy services, but in a less structured manner, without assignment to specific outpatient care programs.

In 2016/17, 83% of respondents reported assignment of a designated pharmacist to at least one outpatient practice area vs. 78% in 2013/14.

- The national average number of outpatient care programs with an assigned pharmacist was 2.8 ± 2.4 programs per facility (range 0–15), with an average of 2.7 ± 2.6 programs in BC/YT, 2.2 ± 2.5 programs in the Prairies, 3.1 ± 2.4 programs in ON, 3.3 ± 2.3 programs in QC and 2.8 ± 2.1 programs in the Atlantic provinces. These averages are essentially unchanged from 2013/14.

- The percentage of respondents who reported assignment of pharmacists to particular outpatient care programs ranged from 5% (6/126) for gynecology and/or obstetrics to 83% (99/119) for hematology–oncology (Table B-1).

- The frequency of pharmacist assignment to outpatient care programs in the emergency department increased from 57% (81/141) in 2013/14 to 67% (113/169) in 2016/17. For other comparisons between 2013/14 and 2016/17, the frequency of pharmacist assignment to outpatient care programs decreased from 15% (7/48) to 12% (4/33) for asthma and/or allergy and from 32% (26/81) to 24% (18/74) for diabetes. For the following outpatient program types, the frequency of pharmacist assignment to the program was virtually unchanged from 2013/14 to 2016/17: hematology–anticoagulation, hematology–oncology, infectious disease/AIDS/antimicrobial stewardship, renal dialysis, transplantation, geriatrics, pain and/or palliative care, mental health, general surgery, general medicine, neurology and/or stroke, gynecology and/or obstetrics, and rehabilitation.

Assignment of pharmacists to an outpatient program ranged from 5% of respondents for gynecology and/or obstetrics to 83% of respondents for hematology–oncology

- Among respondents who reported assignment of a pharmacist to particular outpatient care programs, the proportion doing so was generally higher for teaching hospitals than for non-teaching hospitals, except for hematology-oncology, rehabilitation, pain and/or palliative care, and diabetes. All pediatric hospitals (7/7) reported assignment of pharmacists to outpatient hematology–oncology programs.

- Among respondents who reported assignment of a pharmacist to outpatient care programs, the proportion doing so was usually higher for respondents from larger hospitals (i.e., > 500 beds vs. 201–500 beds) except hematology–oncology, neurology and/or stroke, and asthma and/or allergy.

- Regional differences were also noted for assignment of pharmacists to certain outpatient care programs, including the following: for mental health, 4% (1/27) in QC vs. 15% (20/134) nationally; for hematology–oncology, 50% (8/16) in the Prairies vs. 83% (99/119) nationally; for neurology and/or stroke, 36% (5/14) in the Prairies and 7% (6/81) nationally. Such differences may reflect the absence of a plan for standardized pharmaceutical care across the country.

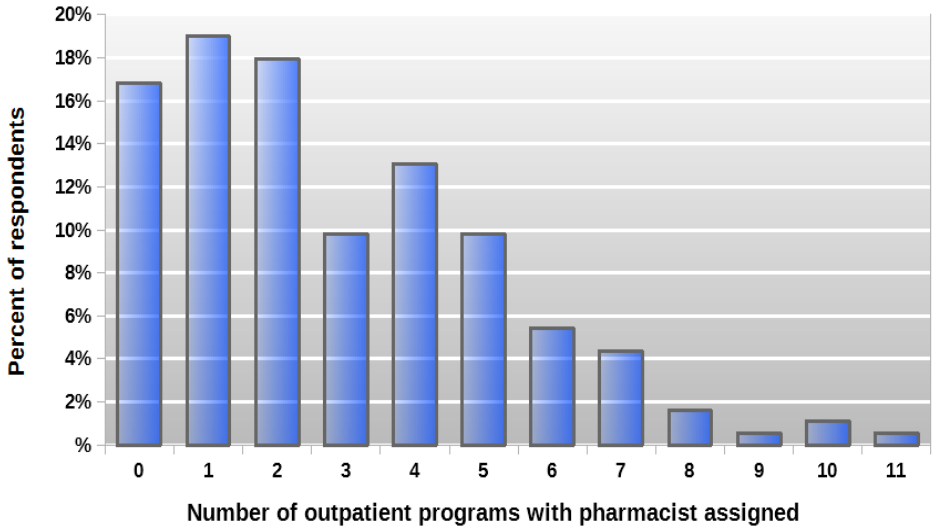
Table B-1 summarizes the profile of pharmacist assignment to outpatient care programs in 2016/17. Figure B-2 illustrates the distribution of outpatient care programs with assignment of pharmacists. Relative to 2013/14, the distribution for 2016/17 has shifted toward the right, indicating an increase in the percentage of outpatient care programs with pharmacists assigned.

Table B-1. Profile of Pharmacist Assignment to Outpatient Programs, 2016/17

Outpatient Services		All	Bed Size			Hospital Type			Region				
			50-200	201- 500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Hematology - oncology	program exists (n=)	(119)	(20)	(55)	(44)	(30)	(82)	(7)	(16)	(16)	(36)	(35)	(16)
	pharmacist assigned	99	14	49	36	22	70	7	10	8	34	33	14
		83%	**70%**	**89%**	**82%**	**73%**	**85%**		**63%**	**50%**	**94%**	**94%**	**88%**
Emergency	program exists (n=)	(169)	(41)	(77)	(51)	(40)	(124)	(5)	(25)	(30)	(51)	(43)	(20)
	pharmacist assigned	113	15	55	43	30	80	3	15	17	38	33	10
		67%	**37%**	**71%**	**84%**	**75%**	**65%**		**60%**	**57%**	**75%**	**77%**	**50%**
Renal dialysis	program exists (n=)	(108)	(20)	(46)	(42)	(29)	(74)	(5)	(13)	(21)	(32)	(26)	(16)
	pharmacist assigned	70	6	33	31	22	45	3	12	8	22	16	12
		65%	**30%**	**72%**	**74%**	**76%**	**61%**		**92%**	**38%**	**69%**	**62%**	**75%**
Transplantation	program exists (n=)	(28)	(2)	(11)	(15)	(22)	(1)	(5)	(4)	(8)	(7)	(6)	(3)
	pharmacist assigned	18	0	7	11	16	0	2	4	5	4	4	1
		64%	**0%**	**64%**	**73%**	**73%**	**0%**						
Hematology - anticoagulation	program exists (n=)	(66)	(3)	(30)	(33)	(28)	(36)	(2)	(11)	(12)	(19)	(17)	(7)
	pharmacist assigned	40	1	17	22	18	22	0	7	9	10	10	4
		61%	**33%**	**57%**	**67%**	**64%**	**61%**		**64%**	**75%**	**53%**	**59%**	
Cardiovascular and/or lipid	program exists (n=)	(88)	(7)	(46)	(35)	(35)	(50)	(3)	(13)	(16)	(31)	(20)	(8)
	pharmacist assigned	32	0	13	19	14	18	0	6	7	9	7	3
		36%	**0%**	**28%**	**54%**	**40%**	**36%**		**46%**	**44%**	**29%**	**35%**	
Infectious disease/ AIDS/ antimicrobial stewardship	program exists (n=)	(117)	(17)	(56)	(44)	(38)	(74)	(5)	(16)	(16)	(42)	(27)	(16)
	pharmacist assigned	36	3	12	21	16	17	3	8	8	6	9	5
		31%	**18%**	**21%**	**48%**	**42%**	**23%**		**50%**	**50%**	**14%**	**33%**	**31%**
Diabetes	program exists (n=)	(74)	(10)	(36)	(28)	(21)	(51)	(2)	(6)	(12)	(28)	(19)	(9)
	pharmacist assigned	18	2	7	9	4	14	0	1	1	7	7	2
		24%	**20%**	**19%**	**32%**	**19%**	**27%**			**8%**	**25%**	**37%**	
Geriatrics	program exists (n=)	(95)	(5)	(47)	(43)	(30)	(65)	(0)	(16)	(17)	(27)	(28)	(7)
	pharmacist assigned	19	0	7	12	9	10	0	5	4	5	3	2
		20%	**0%**	**15%**	**28%**	**30%**	**15%**		**31%**	**24%**	**19%**	**11%**	
Mental health	program exists (n=)	(134)	(23)	(66)	(45)	(37)	(91)	(6)	(21)	(26)	(42)	(27)	(18)
	pharmacist assigned	20	0	10	10	7	13	0	2	4	11	1	2
		15%	**0%**	**15%**	**22%**	**19%**	**14%**		**10%**	**15%**	**26%**	**4%**	**11%**
Pain and/or palliative care	program exists (n=)	(107)	(20)	(50)	(37)	(32)	(70)	(5)	(17)	(20)	(34)	(23)	(13)
	pharmacist assigned	13	1	6	6	3	8	2	5	1	2	5	0
		12%	**5%**	**12%**	**16%**	**9%**	**11%**		**29%**	**5%**	**6%**	**22%**	**0%**
Asthma and/or allergy	program exists (n=)	(33)	(3)	(17)	(13)	(15)	(14)	(4)	(1)	(4)	(9)	(12)	(7)
	pharmacist assigned	4	0	3	1	3	1	0	0	0	1	2	1
		12%	**0%**	**18%**	**8%**	**20%**	**7%**					**17%**	
Neurology and/or stroke	program exists (n=)	(81)	(12)	(37)	(32)	(27)	(49)	(5)	(10)	(14)	(33)	(12)	(12)
	pharmacist assigned	6	1	3	2	4	1	1	0	5	0	1	0
		7%	**8%**	**8%**	**6%**	**15%**	**2%**		**0%**	**36%**	**0%**	**8%**	**0%**
General surgery	program exists (n=)	(151)	(37)	(67)	(47)	(38)	(110)	(3)	(26)	(31)	(48)	(29)	(17)
	pharmacist assigned	11	1	6	4	4	7	0	1	2	7	1	0
		7%	**3%**	**9%**	**9%**	**11%**	**6%**		**4%**	**6%**	**15%**	**3%**	**0%**
General medicine	program exists (n=)	(155)	(40)	(69)	(46)	(38)	(111)	(6)	(27)	(33)	(46)	(30)	(19)
	pharmacist assigned	10	2	3	5	3	6	1	2	2	1	4	1
		6%	**5%**	**4%**	**11%**	**8%**	**5%**		**7%**	**6%**	**2%**	**13%**	**5%**
Rehabilitation	program exists (n=)	(81)	(15)	(37)	(29)	(13)	(66)	(2)	(11)	(12)	(32)	(15)	(11)
	pharmacist assigned	5	0	1	4	0	5	0	0	0	2	3	0
		6%	**0%**	**3%**	**14%**	**0%**	**8%**		**0%**	**0%**	**6%**	**20%**	**0%**
Gynecology and/or Obstetrics	program exists (n=)	(126)	(29)	(57)	(40)	(30)	(93)	(3)	(19)	(25)	(43)	(25)	(14)
	pharmacist assigned	6	1	3	2	2	2	2	1	2	0	1	2
		5%	**3%**	**5%**	**5%**	**7%**	**2%**		**5%**	**8%**	**0%**	**4%**	**14%**

Base: Respondents who answered question about outpatient services
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Figure B-2. Respondents Providing Outpatient Clinical Pharmacy Services, 2016/17



Base: All respondents (n=184)

Profile of Inpatient Clinical Pharmacy Services

- In the 2016/17 survey, 97% (178/184) of respondents reported assignment of a designated pharmacist to at least 1 of the 18 inpatient practice areas listed. This is the highest value ever documented, well above the 90% (147/163) reported for 2013/14 and similar values in previous reports.

In 2016/17, 97% of respondents reported assignment of a designated pharmacist to at least one inpatient practice area vs. 90% in 2013/14.

- The national average number of inpatient care programs with an assigned pharmacist was 6.8 ± 3.8 programs per facility (range 0–16), with an average of 6.4 ± 4.1 in BC/YT, 5.5 ± 3.9 in the Prairies, 9.3 ± 3.1 in ON, 5.7 ± 3.0 in QC and 5.9 ± 3.9 in the Atlantic provinces.

- The percentage of respondents who reported assignment of pharmacists to particular inpatient care programs ranged from 12% (9/78) for diabetes to 88% (151/172) for general medicine (Table B-2).

Assignment of pharmacists to an inpatient care program ranged from 12% of respondents for diabetes to 88% of respondents for general medicine.

- The frequencies of pharmacist assignment to specific inpatient care programs in 2016/17 were similar to those documented in the 2013/14 report, with the following exceptions: for hematology–anticoagulation, decrease from 36% (25/69) in 2013/14 to 25% (17/69) in 2016/17; for transplantation, decrease from 87% (20/23) to 81% (25/31); for hematology–oncology, increase from 55% (61/110) to 61% (72/118); for pediatric and/or neonatal critical care, increase from 72% (52/72) to 78% (70/90); and for general surgery, increase from 69% (101/147) to 74% (122/165). The increases may reflect the Required Organizational Practices of Accreditation Canada for antimicrobial stewardship and medication reconciliation.[19]

- Among respondents who reported assignment of a pharmacist to particular inpatient care programs, the proportion doing so was usually higher for teaching hospitals than for non-teaching hospitals, notably for inpatient care programs in hematology–oncology, cardiovascular and/or lipid and pediatric and/or neonatal critical care. However, greater proportions of respondents from non-teaching hospitals than teaching hospitals reported pharmacist-supported inpatient geriatrics and diabetes programs. Among the pediatric hospitals, all respondents with these programs reported that pharmacists were assigned to inpatient care programs in general medicine, cardiovascular and/or lipid, pediatric and/or neonatal critical care, hematology–oncology, and hematology–anticoagulation.

Table B-2 summarizes the profile of pharmacist assignment to inpatient care programs in 2016/17.

Table B-2. Profile of Pharmacist Assignment to Inpatient Programs, 2016/17

Inpatient Services		All	Bed Size			Hospital Type			Region				
			50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
General medicine	program exists (n=)	(172)	(47)	(75)	(50)	(39)	(127)	(6)	(28)	(37)	(50)	(37)	(20)
	pharmacist assigned	151	42	65	44	38	107	6	26	33	50	28	14
		88%	**89%**	**87%**	**88%**	**97%**	**84%**		**93%**	**89%**	**100%**	**76%**	**70%**
Infectious disease/ AIDS/ antimicrobial stewardship	program exists (n=)	(130)	(21)	(62)	(47)	(39)	(85)	(6)	(17)	(16)	(47)	(33)	(17)
	pharmacist assigned	111	17	53	41	36	71	4	12	11	45	28	15
		85%	**81%**	**85%**	**87%**	**92%**	**84%**		**71%**	**69%**	**96%**	**85%**	**88%**
Adult critical care	program exists (n=)	(163)	(36)	(75)	(52)	(39)	(124)	(0)	(24)	(29)	(50)	(41)	(19)
	pharmacist assigned	139	26	66	47	38	101	0	24	23	47	30	15
		85%	**72%**	**88%**	**90%**	**97%**	**81%**		**100%**	**79%**	**94%**	**73%**	**79%**
Transplantation	program exists (n=)	(31)	(4)	(12)	(15)	(24)	(1)	(6)	(4)	(8)	(8)	(8)	(3)
	pharmacist assigned	25	1	11	13	20	1	4	3	5	8	6	3
		81%	**25%**	**92%**	**87%**	**83%**	**100%**		**75%**	**63%**	**100%**	**75%**	
Cardiovascular and/or lipid	program exists (n=)	(91)	(7)	(47)	(37)	(35)	(53)	(3)	(13)	(16)	(31)	(23)	(8)
	pharmacist assigned	71	5	37	29	32	36	3	13	14	29	10	5
		78%	**71%**	**79%**	**78%**	**91%**	**68%**		**100%**	**88%**	**94%**	**43%**	
Pediatric and/or neonatal critical care	program exists (n=)	(90)	(14)	(41)	(35)	(26)	(59)	(5)	(13)	(20)	(36)	(13)	(8)
	pharmacist assigned	70	8	34	28	24	41	5	8	15	34	9	4
		78%	**57%**	**83%**	**80%**	**92%**	**69%**		**62%**	**75%**	**94%**	**69%**	
Geriatrics	program exists (n=)	(100)	(5)	(52)	(43)	(30)	(70)	(0)	(16)	(17)	(26)	(34)	(7)
	pharmacist assigned	76	3	38	35	20	56	0	12	9	21	29	5
		76%	**60%**	**73%**	**81%**	**67%**	**80%**		**75%**	**53%**	**81%**	**85%**	
General surgery	program exists (n=)	(165)	(43)	(73)	(49)	(38)	(123)	(4)	(28)	(34)	(50)	(36)	(17)
	pharmacist assigned	122	29	57	36	32	88	2	23	23	48	18	10
		74%	**67%**	**78%**	**73%**	**84%**	**72%**		**82%**	**68%**	**96%**	**50%**	**59%**
Mental health	program exists (n=)	(141)	(26)	(68)	(47)	(37)	(97)	(7)	(22)	(27)	(43)	(31)	(18)
	pharmacist assigned	92	14	45	33	28	60	4	14	17	36	13	12
		65%	**54%**	**66%**	**70%**	**76%**	**62%**		**64%**	**63%**	**84%**	**42%**	**67%**
Neurology and/or stroke	program exists (n=)	(86)	(12)	(39)	(35)	(28)	(53)	(5)	(12)	(14)	(34)	(14)	(12)
	pharmacist assigned	55	6	27	22	20	32	3	10	7	26	5	7
		64%	**50%**	**69%**	**63%**	**71%**	**60%**		**83%**	**50%**	**76%**	**36%**	**58%**
Hematology - oncology	program exists (n=)	(118)	(18)	(54)	(46)	(30)	(81)	(7)	(15)	(15)	(35)	(37)	(16)
	pharmacist assigned	72	8	30	34	23	42	7	8	10	23	23	8
		61%	**44%**	**56%**	**74%**	**77%**	**52%**		**53%**	**67%**	**66%**	**62%**	**50%**
Rehabilitation	program exists (n=)	(90)	(16)	(43)	(31)	(13)	(75)	(2)	(14)	(14)	(33)	(18)	(11)
	pharmacist assigned	54	7	26	21	9	44	1	10	7	27	8	2
		60%	**44%**	**60%**	**68%**	**69%**	**59%**		**71%**	**50%**	**82%**	**44%**	**18%**
Pain and/or palliative care	program exists (n=)	(115)	(22)	(53)	(40)	(32)	(78)	(5)	(17)	(20)	(35)	(29)	(14)
	pharmacist assigned	67	12	28	27	19	45	3	9	10	22	19	7
		58%	**55%**	**53%**	**68%**	**59%**	**58%**		**53%**	**50%**	**63%**	**66%**	**50%**
Gynecology and/or Obstetrics	program exists (n=)	(136)	(34)	(61)	(41)	(30)	(102)	(4)	(20)	(27)	(45)	(30)	(14)
	pharmacist assigned	60	13	31	16	13	44	3	9	8	38	2	3
		44%	**38%**	**51%**	**39%**	**43%**	**43%**		**45%**	**30%**	**84%**	**7%**	**21%**
Renal dialysis	program exists (n=)	(111)	(23)	(45)	(43)	(29)	(76)	(6)	(13)	(22)	(33)	(27)	(16)
	pharmacist assigned	47	6	15	26	13	31	3	6	7	17	10	7
		42%	**26%**	**33%**	**60%**	**45%**	**41%**		**46%**	**32%**	**52%**	**37%**	**44%**
Hematology - anticoagulation	program exists (n=)	(69)	(3)	(31)	(35)	(29)	(38)	(2)	(12)	(13)	(20)	(17)	(7)
	pharmacist assigned	17	3	7	7	8	7	2	3	4	5	3	2
		25%	**100%**	**23%**	**20%**	**28%**	**18%**		**25%**	**31%**	**25%**	**18%**	
Asthma and/or allergy	program exists (n=)	(36)	(4)	(18)	(14)	(15)	(16)	(5)	(1)	(4)	(9)	(15)	(7)
	pharmacist assigned	6	0	4	2	3	1	2	0	0	1	3	2
		17%	**0%**	**22%**	**14%**	**20%**	**6%**		**0%**	**0%**	**11%**	**20%**	
Diabetes	program exists (n=)	(78)	(12)	(38)	(28)	(21)	(54)	(3)	(6)	(13)	(28)	(22)	(9)
	pharmacist assigned	9	2	4	3	0	8	1	1	2	5	1	0
		12%	**17%**	**11%**	**11%**	**0%**	**15%**		**17%**	**15%**	**18%**	**5%**	

Base: Respondents who answered question about inpatient services
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons

- Among respondents who reported assignment of a pharmacist to particular inpatient care programs, the proportion doing so was usually higher for larger hospitals (e.g., > 500 beds vs. 50–200 beds) notably for programs in transplantation, hematology–oncology, and renal dialysis. The smaller hospitals (50–200 beds) had higher percentages of pharmacist assignment to inpatient care programs in hematology–anticoagulation and diabetes.

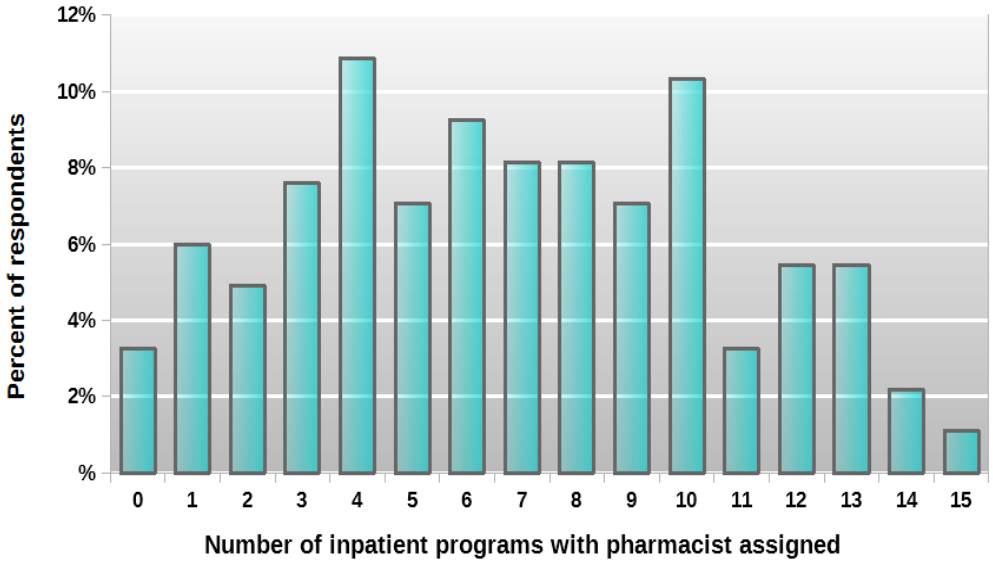
- Regionally, the proportion of respondents who reported assignment of pharmacists to inpatient care programs was lower in QC than in other areas for many program types. This result may be related to the

vacancy rates for pharmacists in QC, which remain considerably higher than pharmacist vacancy rates in most other regions (see Chapter D, Human Resources).

- There were many other regional differences in percentages of respondents who reported assignment of pharmacists to certain inpatient care programs: for geriatrics, 53% (9/17) in the Prairies vs. 76% (76/100) nationally; for transplantation, 75% (6/8) in QC vs. 81% (25/31) nationally; for cardiovascular and/or lipids, 43% (10/23) in QC and 100% (13/13) in BC/YT vs. 78% (71/91) nationally; for infectious disease/AIDS/Antimicrobial Stewardship, 69% (11/16) in the Prairies vs. 85% (111/130) nationally; for general surgery, 96% (48/50) in ON vs. 74% (122/165) nationally; for rehabilitation, 44% (8/18) in QC and 82% (27/33) in ON vs. 60% (54/90) nationally; for neurology and/or stroke, 36% (5/14) in QC and 83% (10/12) in BC/YT vs. 64% (55/86) nationally; for renal dialysis, 32% (7/22) in the Prairies vs. 42% (47/111) nationally; for gynecology and/or obstetrics, 7% (2/30) in QC and 84% (38/45) in ON vs. 44% (60/136) nationally; for hematology–anticoagulation, 18% (3/17) in QC vs. 25% (17/69) nationally; and for asthma and/or allergy, 29% (2/7) in the Atlantic provinces vs. 17% (6/36) nationally.

Figure B-3 illustrates the distribution of inpatient care programs with assignment of pharmacists.

Figure B-3. Respondents Providing Inpatient Clinical Pharmacy Services, 2016/17



Base: All respondents (n=184)

The 2016/17 survey results show a progressive increase in the number of patient care programs with assignment of pharmacists. The results also show the widespread assignment of pharmacists to both inpatient and outpatient programs. Although the data may suggest prioritization according to the availability of decentralized pharmacists, the authors of this chapter believe that all patients should benefit from pharmacist services and that currently available resources should be taken into account when determining the level of clinical pharmacist services to be provided.

Further evidence of the value of pharmacist involvement in patient care programs, irrespective of whether they are provided on an inpatient or outpatient/ambulatory basis, has been published since the 2013/14 report, including American Society of Health-System Pharmacists (ASHP) guidelines for the minimum standard for ambulatory care[20] and studies on the role of non-dispensing pharmacists in primary care,[21] the impact of medication reviews in long-term care facilities[22] and the utility of remote clinical pharmacy, such as telepharmacy.[23,24,25,26] There have also been publications addressing pharmacists' involvement in disease management (e.g., heart failure,[27] other cardiovascular diseases,[28] obstructive sleep apnea disorders,[29] inflammatory diseases,[30] multiple sclerosis,[31] hematologic malignancies,[32] HIV[33] and other chronic diseases[34]) and their involvement in various patient care programs (e.g., pediatrics,[35] antimicrobial stewardship programs,[36] surgery,[37] veterans healthcare,[38] parenteral nutrition,[39] monitoring of adverse health outcomes,[40] critical care and medication errors,[41] management of drug–drug interactions,[42] medication underuse,[43] medication reconciliation,[44,45,46] medication therapy management,[47] care transitions,[48,49] pharmacogenomics[50,51] and medical device evaluation[52]).

Clinical pharmacy practice should be pivotal in the organizational plan of a pharmacy department, but there also needs to be strong leadership supporting such orientation and development for the future.[53,54] Studies have been published demonstrating the effectiveness and impact of clinical pharmacy services over time.[55,56,57,58,59] Some published studies have shown negative clinical outcomes associated with clinical pharmacy services,[60] but such results are scarce. Further evolution of clinical pharmacy practice should rely on pharmacy practice research, which should begin during residency training and continue throughout the pharmacist's career.[11,61,62,63]

Clinical pharmacy practice should be pivotal in a pharmacy department's organizational plan, with strong leadership supporting such orientation and its future development.

Pharmacy Practice Models

The pharmacy practice model of a particular institution is the method by which the pharmacy department's resources are used to provide patient care services. It also encompasses the outcomes to be achieved through the particular model of resource utilization. The pharmacy practice model specifies the roles played by pharmacists, pharmacy technicians, students, information technologies and automation technologies.

The ASHP and the ASHP Foundation have a common goal of significantly advancing healthcare by supporting models that effectively use pharmacists as direct patient care providers. These organizations have developed a series of self-assessment tools and resources through their Practice Advancement Initiative (PAI).[64] Use of these tools has helped US-based organizations to develop successful pharmacy practice models in both hospital and ambulatory care settings. The PAI also provides tools to help engage senior leadership, a necessity in a time when financial resources are scare and all decisions must be justified with evidence. The PAI has tracked progress in many areas, such as medication-related continuity of care and antimicrobial stewardship, from 2011 to 2017.[65]

Given the practice model definitions developed recently by both ACCP and ASHP, the Hospital Pharmacy in Canada Survey Board revised practice model descriptions for the 2016/17 survey. Four practice models were defined, and respondents were asked to specify the model that best described deployment of pharmacists in their facilities, rather than stating the proportion of resources devoted to each model, as was requested in previous surveys.

- In the 2016/17 survey, the question about practice models was answered by183 of the 184 respondents.
- Two models appeared dominant: the clinical generalist (integrated) model, with limited differentiation of pharmacist roles (i.e., nearly all pharmacists have both distributive and clinical responsibilities) (45%, 83/183), and the comprehensive model, with pharmacists assigned to distributive, generalist/integrated and specialist roles (43%, 78/183).

Two models of pharmacy practice appeared dominant: the clinical generalist (integrated) model and the comprehensive model.

- The practice model with "mostly distributive pharmacists with limited clinical services" was most common in the Atlantic region (24%, 5/21).
- It is encouraging that only a small percentage of respondents nationally (8%, 15/183) had mostly distributive pharmacists with limited clinical services.
- The practice model with "separate clinical specialist and distributive roles" was generally rare, but most prevalent in QC (9%, 4/43); the clinical professor tenure in Quebec faculties of pharmacy could be a contributing factor.

Only 8% of respondents indicated that pharmacists at their institutions performed mostly distributive functions, with limited provision of clinical services.

- Ideally, the progression should be toward the comprehensive model, in which pharmacists work in distributive, generalist/integrated and specialist roles. This shift was evident among larger hospitals (51%, 27/53), teaching hospitals (73%, 30/41), pediatric hospitals (5 of 7) and regionally in BC/YT (53%, 16/30).

Table B-3 summarizes the distribution of clinical pharmacy practice models.

Table B-3. Pharmacy Practice Models, 2016/17

Practice Model (Best description of deployment of pharmacists)	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
(n=)	(183)	(49)	(81)	(53)	(41)	(135)	(7)	(30)	(37)	(52)	(43)	(21)
Clinical generalist model with limited differentiation of roles	83 **45%**	32 **65%**	30 **37%**	21 **40%**	10 **24%**	72 **53%**	1	12 **40%**	21 **57%**	28 **54%**	14 **33%**	8 **38%**
Comprehensive model, including pharmacists in distributive, generalist, specialist roles	78 **43%**	9 **18%**	42 **52%**	27 **51%**	30 **73%**	43 **32%**	5	16 **53%**	15 **41%**	21 **40%**	19 **44%**	7 **33%**
Mostly distributive pharmacists with limited clinical services	15 **8%**	5 **10%**	8 **10%**	2 **4%**	0 **0%**	15 **11%**	0	2 **7%**	1 **3%**	1 **2%**	6 **14%**	5 **24%**
Separate clinical specialist and distributive roles	7 **4%**	3 **6%**	1 **1%**	3 **6%**	1 **2%**	5 **4%**	1	0 **0%**	0 **0%**	2 **4%**	4 **9%**	1 **5%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons

Profile of Clinical Pharmacy Activities

A web-based platform is now available that presents the best published evidence pertaining to the role and impact of pharmaceutical activities.[66,67] This platform was developed by a Canadian research team on the basis of a structured and reproducible search and analytical method to describe the evidence, according to 100 themes, concerning patient care programs, diseases and pharmaceutical activities.[68] The team has described three approaches to optimize use of this website and its data, which are applicable to pharmacy students and residents, pharmacists and clinicians, as well as other healthcare decision-makers. The website can be accessed without a login or password, and includes reference lists, article summaries (currently available only in French), fact sheets (also available only in French), knowledge transfer strategies and the profiles of team members. A weekly blog (http://impactpharmacie.wordpress.com) is also maintained to comment on recently published studies.

The 2016/17 iteration of the Hospital Pharmacy in Canada Survey Board included a re-design of questions about the type and level of clinical pharmacy services provided. We used a selection of questions similar to those in the PAI Hospital Self-Assessment Tool to address the targeted topics important for clinical pharmacy practice in Canadian hospitals. Respondents were asked questions about 20 clinical activities and the extent to which these had been implemented and performed within their organization, as of March 31, 2017.

The following is a summary of key observations (representing the sum of responses for implementation in "all areas" and "most areas"); however, because these re-designed questions about clinical activities were new in the 2016/17 survey, comparison with previous surveys is not possible:

- The extent of clinical activity implementation was higher in teaching than in non-teaching hospitals.

- The following activities were widely implemented (i.e., reported by more than 50% of respondents):
  - Involvement of pharmacists in identifying, developing, reviewing or approving new medication order sets (91%, 167/184).
  - Identification by the facility's pharmacy department of drug therapy management as a service that should be provided consistently by pharmacists (82%, 150/183).
  - Adjustment by pharmacists of medication dosing, on the basis of the patient's response or pharmacokinetic characteristics (75%, 139/184).
  - Review of medication orders by a pharmacist before the first dose is administered (75%, 137/183).
  - Prioritization of drug therapy management services for inpatients, according to the complexity of patients' medication therapy (73%, 134/183).
  - Involvement of pharmacists in monitoring and reporting potential and actual adverse drug events (71%, 131/184)

Two widely implemented activities were involvement of pharmacists in new medication order sets and consistent provision of drug therapy management by pharmacists.

- For two clinical activities, substantial numbers of respondents reported that pharmacists were not involved at their facilities:
  - More than three-quarters of respondents (78%, 126/161) reported that no pharmacists participated on the facility's rapid response teams, and 75% (128/170) reported that no pharmacists

participated on the facility's cardiopulmonary resuscitation teams. Although the value of pharmacists on rapid response and cardiopulmonary resuscitation teams has been documented, it can be difficult to have pharmacists available to perform these activities 24 hours per day, 7 days a week.

- For two other clinical activities, implementation was somewhat limited but can be expected to grow in the future:
  - For patients whose genetic characteristics are known, 54% (84/156) of respondents reported that pharmacists had no role in adjusting dosing or changing therapy for select medications (e.g., through results of genetic tests for variants of the CYP2C9 and VKORC1 genes for patients receiving warfarin therapy). This is an emerging clinical activity for pharmacists and should be integrated in any pharmaceutical care plan.
  - More than one-third of respondents (36%, 59/164) reported that their facilities' outpatient pharmacists were not authorized by policy or protocol to write medication orders and/or prescriptions as part of their scope of practice, and 22% (40/182) reported that inpatient pharmacists were not authorized to do so. The right to adapt or manage medication orders has been granted to pharmacists in most provinces; the right to prescribe independently and in collaboration has been also given to pharmacists in several provinces.[69]

The right to adapt or manage medication orders has been granted to pharmacists in most provinces.

Overall, the information about clinical pharmacy activities gathered in the 2016/17 survey may be useful for regional comparisons and for helping organizations to prioritize activities for implementation. The data will be especially useful when combined with data from future surveys to track progress.

Table B-4 summarizes the profile of clinical pharmacy activities for 2016/17.

Table B-4. Profile of Clinical Pharmacy Activities, 2016/17

Clinical Pharmacy Activities	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Pharmacists are involved in identifying, developing, reviewing or approving new medication order sets (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	84	21	38	25	20	62	2	11	10	35	17	11
	46%	**42%**	**47%**	**47%**	**49%**	**46%**		**37%**	**26%**	**67%**	**40%**	**52%**
Exists in most areas (50-99%)	83	23	37	23	20	58	5	12	26	16	22	7
	45%	**46%**	**46%**	**43%**	**49%**	**43%**		**40%**	**68%**	**31%**	**51%**	**33%**
Exists in some areas (1-49%)	13	4	4	5	1	12	0	4	2	1	4	2
	7%	8%	5%	9%	2%	9%		13%	5%	2%	9%	10%
Does not exist (0%)	4	2	2	0	0	4	0	3	0	0	0	1
	2%	4%	2%	0%	0%	3%		10%	0%	0%	0%	5%
The pharmacy department at your facility has identified drug therapy management as a service that should be provided consistently by pharmacists (n=)	(183)	(50)	(81)	(52)	(41)	(135)	(7)	(30)	(38)	(52)	(42)	(21)
Exists in all areas (100%)	53	13	23	17	16	37	0	11	5	23	8	6
	29%	**26%**	**28%**	**33%**	**39%**	**27%**		**37%**	**13%**	**44%**	**19%**	**29%**
Exists in most areas (50-99%)	97	27	45	25	22	68	7	13	26	27	24	7
	53%	**54%**	**56%**	**48%**	**54%**	**50%**		**43%**	**68%**	**52%**	**57%**	**33%**
Exists in some areas (1-49%)	26	8	8	10	3	23	0	4	5	2	9	6
	14%	16%	10%	19%	7%	17%		13%	13%	4%	21%	29%
Does not exist (0%)	7	2	5	0	0	7	0	2	2	0	1	2
	4%	4%	6%	0%	0%	5%		7%	5%	0%	2%	10%
Pharmacists adjust dosing of medications on the basis of the patient's response or pharmacokinetic characteristics (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	28	5	11	12	9	18	1	7	2	11	6	2
	15%	**10%**	**14%**	**23%**	**22%**	**13%**		**23%**	**5%**	**21%**	**14%**	**10%**
Exists in most areas (50-99%)	111	29	54	28	28	78	5	18	28	31	25	9
	60%	**58%**	**67%**	**53%**	**68%**	**57%**		**60%**	**74%**	**60%**	**58%**	**43%**

Table B-4 continued

Clinical Pharmacy Activities	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Exists in some areas (1-49%)	41	13	15	13	4	36	1	5	6	9	12	9
	22%	26%	19%	25%	10%	26%		17%	16%	17%	28%	43%
Does not exist (0%)	4	3	1	0	0	4	0	0	2	1	0	1
	2%	6%	1%	0%	0%	3%		0%	5%	2%	0%	5%
Pharmacists review medication orders before the first dose is administered (n=)	(183)	(50)	(81)	(52)	(41)	(135)	(7)	(30)	(38)	(52)	(43)	(20)
Exists in all areas (100%)	2	1	0	1	0	2	0	0	0	1	1	0
	1%	**2%**	**0%**	**2%**	**0%**	**1%**		**0%**	**0%**	**2%**	**2%**	**0%**
Exists in most areas (50-99%)	135	29	64	42	36	94	5	23	21	39	39	13
	74%	**58%**	**79%**	**81%**	**88%**	**70%**		**77%**	**55%**	**75%**	**91%**	**65%**
Exists in some areas (1-49%)	43	17	17	9	5	36	2	7	16	11	3	6
	23%	34%	21%	17%	12%	27%		23%	42%	21%	7%	30%
Does not exist (0%)	3	3	0	0	0	3	0	0	1	1	0	1
	2%	6%	0%	0%	0%	2%		0%	3%	2%	0%	5%
Drug therapy management services are prioritized for inpatients according to the complexity of patients' medication therapy (n=)	(183)	(50)	(81)	(52)	(41)	(135)	(7)	(30)	(38)	(52)	(42)	(21)
Exists in all areas (100%)	22	2	10	10	10	12	0	5	2	8	5	2
	12%	**4%**	**12%**	**19%**	**24%**	**9%**		**17%**	**5%**	**15%**	**12%**	**10%**
Exists in most areas (50-99%)	112	33	48	31	25	80	7	14	28	38	23	9
	61%	**66%**	**59%**	**60%**	**61%**	**59%**		**47%**	**74%**	**73%**	**55%**	**43%**
Exists in some areas (1-49%)	43	12	21	10	6	37	0	10	7	5	13	8
	23%	24%	26%	19%	15%	27%		33%	18%	10%	31%	38%
Does not exist (0%)	6	3	2	1	0	6	0	1	1	1	1	2
	3%	6%	2%	2%	0%	4%		3%	3%	2%	2%	10%
Pharmacists are involved in monitoring and reporting potential and actual adverse drug events (ADEs) (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	39	12	18	9	11	26	2	6	4	18	8	3
	21%	**24%**	**22%**	**17%**	**27%**	**19%**		**20%**	**11%**	**35%**	**19%**	**14%**
Exists in most areas (50-99%)	92	27	36	29	26	61	5	14	26	27	14	11
	50%	**54%**	**44%**	**55%**	**63%**	**45%**		**47%**	**68%**	**52%**	**33%**	**52%**
Exists in some areas (1-49%)	50	8	27	15	4	46	0	10	6	7	21	6
	27%	16%	33%	28%	10%	34%		33%	16%	13%	49%	29%
Does not exist (0%)	3	3	0	0	0	3	0	0	2	0	0	1
	2%	6%	0%	0%	0%	2%		0%	5%	0%	0%	5%
Pharmacists routinely document recommendations and assess progress and achievement of therapeutic goals in patients' medical records (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	22	6	10	6	5	17	0	5	2	9	3	3
	12%	**12%**	**12%**	**11%**	**12%**	**13%**		**17%**	**5%**	**17%**	**7%**	**14%**
Exists in most areas (50-99%)	95	26	40	29	26	63	6	12	24	31	17	11
	52%	**52%**	**49%**	**55%**	**63%**	**46%**		**40%**	**63%**	**60%**	**40%**	**52%**
Exists in some areas (1-49%)	65	17	30	18	10	54	1	13	11	12	22	7
	35%	34%	37%	34%	24%	40%		43%	29%	23%	51%	33%
Does not exist (0%)	2	1	1	0	0	2	0	0	1	0	1	0
	1%	2%	1%	0%	0%	1%		0%	3%	0%	2%	0%
Pharmacists facilitate medication-related continuity of care when patients experience transitions of care (n=)	(183)	(50)	(80)	(53)	(41)	(135)	(7)	(30)	(38)	(52)	(43)	(20)
Exists in all areas (100%)	16	6	6	4	7	7	2	1	2	10	3	0
	9%	**12%**	**8%**	**8%**	**17%**	**5%**		**3%**	**5%**	**19%**	**7%**	**0%**
Exists in most areas (50-99%)	95	23	46	26	26	64	5	14	23	28	21	9
	52%	**46%**	**58%**	**49%**	**63%**	**47%**		**47%**	**61%**	**54%**	**49%**	**45%**
Exists in some areas (1-49%)	66	18	25	23	8	58	0	12	11	14	18	11
	36%	36%	31%	43%	20%	43%		40%	29%	27%	42%	55%
Does not exist (0%)	6	3	3	0	0	6	0	3	2	0	1	0
	3%	6%	4%	0%	0%	4%		10%	5%	0%	2%	0%
Pharmacists monitor patients' responses to medication therapy (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	11	1	5	5	5	6	0	4	1	5	1	0
	6%	**2%**	**6%**	**9%**	**12%**	**4%**		**13%**	**3%**	**10%**	**2%**	**0%**

Table B-4 continued

Clinical Pharmacy Activities	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Exists in most areas (50-99%)	97	26	46	25	30	60	7	11	26	31	19	10
	53%	**52%**	**57%**	**47%**	**73%**	**44%**		**37%**	**68%**	**60%**	**44%**	**48%**
Exists in some areas (1-49%)	69	20	27	22	6	63	0	15	9	16	20	9
	38%	40%	33%	42%	15%	46%		50%	24%	31%	47%	43%
Does not exist (0%)	7	3	3	1	0	7	0	0	2	0	3	2
	4%	6%	4%	2%	0%	5%		0%	5%	0%	7%	10%
Medication reconciliation is performed by pharmacy staff at your facility (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	15	4	9	2	6	8	1	1	0	10	2	2
	8%	**8%**	**11%**	**4%**	**15%**	**6%**		**3%**	**0%**	**19%**	**5%**	**10%**
Exists in most areas (50-99%)	90	24	37	29	25	61	4	6	21	31	22	10
	49%	**48%**	**46%**	**55%**	**61%**	**45%**		**20%**	**55%**	**60%**	**51%**	**48%**
Exists in some areas (1-49%)	66	13	31	22	10	54	2	16	14	10	18	8
	36%	26%	38%	42%	24%	40%		53%	37%	19%	42%	38%
Does not exist (0%)	13	9	4	0	0	13	0	7	3	1	1	1
	7%	18%	5%	0%	0%	10%		23%	8%	2%	2%	5%
Pharmacists are involved in developing patient care plans (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	15	3	6	6	8	6	1	3	2	8	2	0
	8%	**6%**	**7%**	**11%**	**20%**	**4%**		**10%**	**5%**	**15%**	**5%**	**0%**
Exists in most areas (50-99%)	86	20	45	21	26	54	6	14	26	26	13	7
	47%	**40%**	**56%**	**40%**	**63%**	**40%**		**47%**	**68%**	**50%**	**30%**	**33%**
Exists in some areas (1-49%)	74	22	26	26	7	67	0	12	7	17	26	12
	40%	44%	32%	49%	17%	49%		40%	18%	33%	60%	57%
Does not exist (0%)	9	5	4	0	0	9	0	1	3	1	2	2
	5%	10%	5%	0%	0%	7%		3%	8%	2%	5%	10%
All patients' medication profiles reviewed for appropriateness at least once daily by a pharmacist (n=)	(183)	(50)	(81)	(52)	(41)	(135)	(7)	(30)	(38)	(52)	(42)	(21)
Exists in all areas (100%)	11	4	3	4	3	7	1	1	1	6	2	1
	6%	**8%**	**4%**	**8%**	**7%**	**5%**		**3%**	**3%**	**12%**	**5%**	**5%**
Exists in most areas (50-99%)	87	23	36	28	29	53	5	12	22	26	16	11
	48%	**46%**	**44%**	**54%**	**71%**	**39%**		**40%**	**58%**	**50%**	**38%**	**52%**
Exists in some areas (1-49%)	68	17	31	20	7	60	1	12	11	16	22	7
	37%	34%	38%	38%	17%	44%		40%	29%	31%	52%	33%
Does not exist (0%)	17	6	11	0	2	15	0	5	4	4	2	2
	9%	12%	14%	0%	5%	11%		17%	11%	8%	5%	10%
Your facility has processes to ensure medication-related continuity of care for discharged patients (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	18	8	9	1	5	11	2	0	7	8	1	2
	10%	**16%**	**11%**	**2%**	**12%**	**8%**		**0%**	**18%**	**15%**	**2%**	**10%**
Exists in most areas (50-99%)	75	26	32	17	22	50	3	7	23	25	13	7
	41%	**52%**	**40%**	**32%**	**54%**	**37%**		**23%**	**61%**	**48%**	**30%**	**33%**
Exists in some areas (1-49%)	77	12	33	32	13	62	2	17	6	19	25	10
	42%	24%	41%	60%	32%	46%		57%	16%	37%	58%	48%
Does not exist (0%)	14	4	7	3	1	13	0	6	2	0	4	2
	8%	8%	9%	6%	2%	10%		20%	5%	0%	9%	10%
Inpatient pharmacists are authorized by policy or protocol to write medication orders as part of their scope of practice (n=)	(182)	(49)	(80)	(53)	(40)	(135)	(7)	(28)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	45	13	19	13	13	29	3	8	17	13	5	2
	25%	**27%**	**24%**	**25%**	**33%**	**21%**		**29%**	**45%**	**25%**	**12%**	**10%**
Exists in most areas (50-99%)	43	8	17	18	8	34	1	9	7	11	11	5
	24%	**16%**	**21%**	**34%**	**20%**	**25%**		**32%**	**18%**	**21%**	**26%**	**24%**
Exists in some areas (1-49%)	54	10	27	17	15	37	2	4	5	19	21	5
	30%	20%	34%	32%	38%	27%		14%	13%	37%	49%	24%
Does not exist (0%)	40	18	17	5	4	35	1	7	9	9	6	9
	22%	37%	21%	9%	10%	26%		25%	24%	17%	14%	43%
Drug therapy management services are prioritized for outpatients according to the complexity of patients' medication therapy (n=)	(170)	(41)	(78)	(51)	(39)	(125)	(6)	(25)	(36)	(46)	(42)	(21)
Exists in all areas (100%)	12	2	6	4	4	8	0	2	1	4	4	1
	7%	**5%**	**8%**	**8%**	**10%**	**6%**		**8%**	**3%**	**9%**	**10%**	**5%**

Table B-4 continued

Clinical Pharmacy Activities	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Exists in most areas (50-99%)	51	5	26	20	10	39	2	2	7	18	21	3
	30%	**12%**	**33%**	**39%**	**26%**	**31%**		**8%**	**19%**	**39%**	**50%**	**14%**
Exists in some areas (1-49%)	79	20	35	24	23	52	4	13	22	18	14	12
	46%	49%	45%	47%	59%	42%		52%	61%	39%	33%	57%
Does not exist (0%)	28	14	11	3	2	26	0	8	6	6	3	5
	16%	34%	14%	6%	5%	21%		32%	17%	13%	7%	24%
Outpatient pharmacists are authorized by policy or protocol to write medication orders and/or prescriptions as part of their scope of practice (n=)	(164)	(38)	(75)	(51)	(36)	(121)	(7)	(22)	(35)	(45)	(43)	(19)
Exists in all areas (100%)	31	10	11	10	8	20	3	1	16	7	7	0
	19%	**26%**	**15%**	**20%**	**22%**	**17%**		**5%**	**46%**	**16%**	**16%**	**0%**
Exists in most areas (50-99%)	26	1	10	15	7	19	0	4	2	5	14	1
	16%	**3%**	**13%**	**29%**	**19%**	**16%**		**18%**	**6%**	**11%**	**33%**	**5%**
Exists in some areas (1-49%)	48	8	24	16	17	28	3	6	6	11	18	7
	29%	21%	32%	31%	47%	23%		27%	17%	24%	42%	37%
Does not exist (0%)	59	19	30	10	4	54	1	11	11	22	4	11
	36%	50%	40%	20%	11%	45%		50%	31%	49%	9%	58%
Pharmacists provide discharge education to patients at your facility (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
Exists in all areas (100%)	2	0	2	0	1	1	0	0	0	1	1	0
	1%	**0%**	**2%**	**0%**	**2%**	**1%**		**0%**	**0%**	**2%**	**2%**	**0%**
Exists in most areas (50-99%)	48	15	18	15	19	24	5	6	19	14	5	4
	26%	**30%**	**22%**	**28%**	**46%**	**18%**		**20%**	**50%**	**27%**	**12%**	**19%**
Exists in some areas (1-49%)	117	28	54	35	21	94	2	22	14	35	30	16
	64%	56%	67%	66%	51%	69%		73%	37%	67%	70%	76%
Does not exist (0%)	17	7	7	3	0	17	0	2	5	2	7	1
	9%	14%	9%	6%	0%	13%		7%	13%	4%	16%	5%
When a patient's genetic characteristics are known, pharmacists have a role in adjusting dosing or changing therapy for select medications (n=)	(156)	(41)	(73)	(42)	(38)	(111)	(7)	(25)	(34)	(41)	(38)	(18)
Exists in all areas (100%)	4	0	3	1	3	1	0	0	0	4	0	0
	3%	**0%**	**4%**	**2%**	**8%**	**1%**		**0%**	**0%**	**10%**	**0%**	**0%**
Exists in most areas (50-99%)	19	4	10	5	6	11	2	1	4	3	10	1
	12%	**10%**	**14%**	**12%**	**16%**	**10%**		**4%**	**12%**	**7%**	**26%**	**6%**
Exists in some areas (1-49%)	49	11	20	18	15	31	3	7	18	5	16	3
	31%	27%	27%	43%	39%	28%		28%	53%	12%	42%	17%
Does not exist (0%)	84	26	40	18	14	68	2	17	12	29	12	14
	54%	63%	55%	43%	37%	61%		68%	35%	71%	32%	78%
Pharmacists participate in your facility's cardiopulmonary resuscitation teams (n=)	(170)	(48)	(75)	(47)	(39)	(124)	(7)	(24)	(38)	(48)	(41)	(19)
Exists in all areas (100%)	3	0	3	0	3	0	0	1	0	0	2	0
	2%	**0%**	**4%**	**0%**	**8%**	**0%**		**4%**	**0%**	**0%**	**5%**	**0%**
Exists in most areas (50-99%)	10	3	3	4	3	5	2	0	1	0	7	2
	6%	**6%**	**4%**	**9%**	**8%**	**4%**		**0%**	**3%**	**0%**	**17%**	**11%**
Exists in some areas (1-49%)	29	4	14	11	9	19	1	5	4	11	8	1
	17%	8%	19%	23%	23%	15%		21%	11%	23%	20%	5%
Does not exist (0%)	128	41	55	32	24	100	4	18	33	37	24	16
	75%	85%	73%	68%	62%	81%		75%	87%	77%	59%	84%
Pharmacists participate in your facility's rapid response teams (n=)	(161)	(41)	(71)	(49)	(36)	(118)	(7)	(27)	(38)	(41)	(37)	(18)
Exists in all areas (100%)	1	0	1	0	1	0	0	1	0	0	0	0
	1%	**0%**	**1%**	**0%**	**3%**	**0%**		**4%**	**0%**	**0%**	**0%**	**0%**
Exists in most areas (50-99%)	9	3	1	5	1	6	2	0	0	2	5	2
	6%	**7%**	**1%**	**10%**	**3%**	**5%**		**0%**	**0%**	**5%**	**14%**	**11%**
Exists in some areas (1-49%)	25	1	10	14	6	19	0	9	4	3	9	0
	16%	2%	14%	29%	17%	16%		33%	11%	7%	24%	0%
Does not exist (0%)	126	37	59	30	28	93	5	17	34	36	23	16
	78%	90%	83%	61%	78%	79%		63%	89%	88%	62%	89%

Base: All respondents
Note: Sorted by percentage of exists in all and in most areas
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Key Performance Indicators

Key performance indicators (KPIs) are quantifiable measures of quality that reflect the critical success factors of an organization; they are used to track the organization's progress with specific, essential processes and outcomes. More specifically, clinical pharmacy KPIs (cpKPIs) are evidence-based processes of care in the domain of clinical pharmacy that are associated with a meaningful impact on patient outcomes, such as improved morbidity or reduced hospital readmissions; they can be used to both guide and assess hospital pharmacists.

A set of hospital cpKPI was developed using a systematic, national, pan-Canadian consensus-building (modified Delphi) process. The cpKPIs were grouped into eight evidence-informed critical activity areas (see below) representing hospital pharmacists' best practices that demonstrated improvements in meaningful patient outcomes. A cpKPI is defined by five characteristics: it reflects a desired quality practice; it is a metric that can be linked to direct patient care; it is associated with evidence of impact on meaningful patient outcomes; it is pharmacist sensitive; and it is feasible to measure.

The Canadian cpKPI Collaborative spent two years developing a core set of national cpKPIs.[70,71] After a group of panelists completed three Delphi rounds, the following eight candidate cpKPIs of activities performed by pharmacists met the consensus definition: (1) performing admission medication reconciliation, including best possible medication history; (2) participating in inter-professional patient care rounds; (3) completing pharmaceutical care plans; (4) resolving drug therapy problems; (5) providing in-person disease and medication education to patients; (6) providing discharge patient medication education; (7) performing discharge medication reconciliation; and (8) providing bundled, proactive direct patient care activities. Bannerman and others[72] also studied and compared local, provincial and national perspectives on cpKPIs in critical activity areas.

In 2016, Minard and others[73] published a paper on pharmacists' perceptions and acceptance of these cpKPIs. Overall, pharmacists strongly supported the cpKPIs and identified both barriers and facilitators for their implementation. In BC, use of the cpKPIs has facilitated demonstration of the value of clinical pharmacy services and has helped in both creating and maintaining clinical pharmacist positions during periods of financial constraint within the Vancouver Island Health Authority.[74]

The 2016/17 survey was the first in this series to collect data about the eight clinical pharmacy key performance indicators.

The 2016/17 iteration of the Hospital Pharmacy in Canada Survey was the first to investigate cpKPIs. The data collected, including the following key points, will serve as a baseline for subsequent surveys:

- Data were being collected for all eight cpKPIs, ranging from a minimum of 27% (48/180) of respondents who reported data collection for patient education at discharge to a maximum of 57% (105/183) of respondents who reported data collection for medication reconciliation on admission.
- Implementation at the 76%–100% level (where the implementation level refers to the proportion of patients who received the service) was still limited, ranging from a minimum of 6% (3/53) of respondents for pharmaceutical care plans to a maximum of 40% (42/105) for medication reconciliation on admission.
- The percentage of respondents with plans to collect data on particular cpKPIs in 2017/18 ranged from 43% (73/168) for development of a pharmaceutical care plan to 66% (111/167) for medication reconciliation on admission.
- The extent of implementation of cpKPIs was generally higher in large hospitals than in smaller hospitals and was higher in teaching hospitals than in non-teaching hospitals. Overall, ON led implementation on a regional basis, whereas implementation in QC was lagging (for five of the eight cpKPIs, there were no QC respondents who reported 76%–100% implementation); similarly, there were some laggards in the Prairies and the Atlantic provinces.

Overall, 40% of respondents indicated that they had between 76% and 100% implementation of the cpKPIs, with 55% of Ontario facilities having this rate of implementation.

Table B-5 summarizes the profile of the reported use and implementation of cpKPIs in 2016/17.

Table B-5. Profile of the Use and Implementation of cpKPIs, 2016/17

cpKPI	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Proportion of patients who received documented medication reconciliation at admission (n=)	(183)	(50)	(80)	(53)	(40)	(136)	(7)	(29)	(38)	(52)	(43)	(21)
Data collected in 2016/17	105	20	51	34	23	78	4	18	4	42	31	10
	57%	**40%**	**64%**	**64%**	**58%**	**57%**		**62%**	**11%**	**81%**	**72%**	**48%**
Extent of implementing cpKPI (n=)	(105)	(20)	(51)	(34)	(23)	(78)	(4)	(18)	(4)	(42)	(31)	(10)
76-100% implementation	42	12	21	9	11	31	0	3	4	23	9	3
	40%	**60%**	**41%**	**26%**	**48%**	**40%**		**17%**		**55%**	**29%**	**30%**
51-75% implementation	28	4	17	7	6	19	3	7	0	12	7	2
	27%	20%	33%	21%	26%	24%		39%		29%	23%	20%
26-50% implementation	14	2	4	8	3	10	1	2	0	4	7	1
	13%	10%	8%	24%	13%	13%		11%		10%	23%	10%
1-25% implementation	21	2	9	10	3	18	0	6	0	3	8	4
	20%	10%	18%	29%	13%	23%		33%		7%	26%	40%
Plans to collect cpKPI in 2017/18 (n=)	(167)	(43)	(75)	(49)	(38)	(123)	(6)	(27)	(33)	(51)	(37)	(19)
	111	23	51	37	27	81	3	15	7	44	32	13
	66%	53%	68%	76%	71%	66%		56%	21%	86%	86%	68%
Proportion of patients for whom a pharmacist participated in interprofessional patient care rounds (n=)	(182)	(49)	(80)	(53)	(40)	(135)	(7)	(29)	(37)	(52)	(43)	(21)
Data collected in 2016/17	69	17	35	17	14	52	3	23	3	21	12	10
	38%	**35%**	**44%**	**32%**	**35%**	**39%**		**79%**		**40%**	**28%**	**48%**
Extent of implementing cpKPI (n=)	(67)	(16)	(34)	(17)	(14)	(50)	(3)	(22)	(3)	(21)	(11)	(10)
76-100% implementation	17	3	8	6	7	9	1	4	0	9	0	4
	25%	**19%**	**24%**	**35%**	**50%**	**18%**		**18%**		**43%**		**40%**
51-75% implementation	11	3	7	1	2	8	1	4	1	1	4	1
	16%	19%	21%	6%	14%	16%		18%		5%	36%	10%
26-50% implementation	16	3	10	3	3	12	1	5	1	6	4	0
	24%	19%	29%	18%	21%	24%		23%		29%	36%	0%
1-25% implementation	23	7	9	7	2	21	0	9	1	5	3	5
	34%	44%	26%	41%	14%	42%		41%		24%	27%	50%
Plans to collect cpKPI in 2017/18 (n=)	(167)	(44)	(76)	(47)	(37)	(124)	(6)	(28)	(34)	(47)	(39)	(19)
	80	22	35	23	19	57	4	22	7	25	14	12
	48%	50%	46%	49%	51%	46%		79%	21%	53%	36%	63%
Proportion of patients who received documented medication reconciliation at discharge (n=)	(180)	(49)	(79)	(52)	(39)	(134)	(7)	(29)	(37)	(51)	(43)	(20)
Data collected in 2016/17	68	17	29	22	17	49	2	15	1	26	19	7
	38%	**35%**	**37%**	**42%**	**44%**	**37%**		**52%**	**3%**	**51%**	**44%**	**35%**
Extent of implementing cpKPI (n=)	(67)	(17)	(28)	(22)	(17)	(48)	(2)	(15)	(1)	(25)	(19)	(7)
76-100% implementation	12	2	6	4	4	7	1	1	0	4	4	3
	18%	**12%**	**21%**	**18%**	**24%**	**15%**		**7%**		**16%**	**21%**	
51-75% implementation	7	3	2	2	2	5	0	0	0	3	3	1
	10%	18%	7%	9%	12%	10%		0%		12%	16%	
26-50% implementation	17	4	9	4	6	10	1	2	0	8	7	0
	25%	24%	32%	18%	35%	21%		13%		32%	37%	
1-25% implementation	31	8	11	12	5	26	0	12	1	10	5	3
	46%	47%	39%	55%	29%	54%		80%		40%	26%	
Plans to collect cpKPI in 2017/18 (n=)	(166)	(45)	(73)	(48)	(37)	(123)	(6)	(28)	(34)	(50)	(36)	(18)
	108	25	48	35	26	79	3	23	6	40	26	13
	65%	56%	66%	73%	70%	64%		82%	18%	80%	72%	72%
Proportion of patients who received comprehensive direct patient care from a pharmacist (n=)	(179)	(49)	(78)	(52)	(38)	(134)	(7)	(29)	(37)	(51)	(42)	(20)
Data collected in 2016/17	62	16	27	19	18	40	4	16	18	12	10	6
	35%	**33%**	**35%**	**37%**	**47%**	**30%**		**55%**	**49%**	**24%**	**24%**	**30%**
Extent of implementing cpKPI (n=)	(58)	(14)	(25)	(19)	(18)	(36)	(4)	(16)	(15)	(12)	(9)	(6)
76-100% implementation	4	2	2	0	2	2	0	0	1	2	1	0
	7%	**14%**	**8%**	**0%**	**11%**	**6%**		**0%**	**7%**	**17%**		
51-75% implementation	17	3	7	7	8	6	3	1	8	2	4	2
	29%	21%	28%	37%	44%	17%		6%	53%	17%		
26-50% implementation	10	3	4	3	5	5	0	2	6	0	2	0
	17%	21%	16%	16%	28%	14%		13%	40%			
1-25% implementation	27	6	12	9	3	23	1	13	0	8	2	4
	47%	43%	48%	47%	17%	64%		81%	0%	67%		
Plans to collect cpKPI in 2017/18 (n=)	(170)	(47)	(75)	(48)	(35)	(129)	(6)	(29)	(35)	(49)	(39)	(18)
	83	23	30	30	22	57	4	16	19	20	19	9
	49%	49%	40%	63%	63%	44%		55%	54%	41%	49%	50%

Table B-5 continued

cpKPI	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Number of drug therapy problems resolved by a pharmacist per admission (n=)	(182)	(49)	(80)	(53)	(40)	(135)	(7)	(29)	(37)	(52)	(43)	(21)
Data collected in 2016/17	57	16	24	17	11	44	2	23	2	15	9	8
	31%	**33%**	**30%**	**32%**	**28%**	**33%**		**79%**	**5%**	**29%**	**21%**	**38%**
Extent of implementing cpKPI (n=)	(56)	(16)	(23)	(17)	(11)	(43)	(2)	(23)	(2)	(14)	(9)	(8)
76-100% implementation	16	5	6	5	6	10	0	9	1	4	0	2
	29%	**31%**	**26%**	**29%**	**55%**	**23%**		**39%**		**29%**		
51-75% implementation	23	7	12	4	3	18	2	8	1	4	7	3
	41%	44%	52%	24%	27%	42%		35%		29%		
26-50% implementation	8	2	3	3	1	7	0	2	0	4	1	1
	14%	13%	13%	18%	9%	16%		9%		29%		
1-25% implementation	9	2	2	5	1	8	0	4	0	2	1	2
	16%	13%	9%	29%	9%	19%		17%		14%		
Plans to collect cpKPI in 2017/18 (n=)	(163)	(43)	(74)	(46)	(36)	(121)	(6)	(26)	(34)	(48)	(37)	(18)
	71	16	31	24	20	48	3	17	4	22	18	10
	44%	37%	42%	52%	56%	40%		65%		46%	49%	56%
Proportion of patients who received education from a pharmacist about their disease(s) and medication(s) (n=)	(181)	(49)	(80)	(52)	(40)	(134)	(7)	(29)	(37)	(52)	(43)	(20)
Data collected in 2016/17	54	11	29	14	12	40	2	20	0	16	10	8
	30%	**22%**	**36%**	**27%**	**30%**	**30%**		**69%**		**31%**	**23%**	**40%**
Extent of implementing cpKPI (n=)	(54)	(11)	(29)	(14)	(12)	(40)	(2)	(20)	(0)	(16)	(10)	(8)
76-100% implementation	4	1	2	1	2	2	0	0	0	2	0	2
	7%	**9%**	**7%**	**7%**	**17%**	**5%**				**13%**		
51-75% implementation	7	0	6	1	2	3	2	2	0	3	1	1
	13%		21%	7%	17%	8%		10%		19%	10%	
26-50% implementation	13	2	9	2	5	8	0	6	0	3	4	0
	24%	18%	31%	14%	42%	20%		30%		19%	40%	
1-25% implementation	30	8	12	10	3	27	0	12	0	8	5	5
	56%	73%	41%	71%	25%	68%		60%		50%	50%	
Plans to collect cpKPI in 2017/18 (n=)	(168)	(46)	(75)	(47)	(37)	(125)	(6)	(28)	(34)	(49)	(38)	(19)
	72	16	33	23	17	52	3	17	2	25	17	11
	43%	35%	44%	49%	46%	42%		61%	6%	51%	45%	58%
Proportion of patients for whom pharmacists have developed a pharmaceutical care plan (n=)	(180)	(48)	(80)	(52)	(40)	(133)	(7)	(29)	(36)	(51)	(43)	(21)
Data collected in 2016/17	52	13	23	16	11	39	2	19	0	12	14	7
	29%	**27%**	**29%**	**31%**	**28%**	**29%**		**66%**		**24%**	**33%**	**33%**
Extent of implementing cpKPI (n=)	(53)	(14)	(23)	(16)	(11)	(40)	(2)	(19)	(1)	(12)	(14)	(7)
76-100% implementation	3	0	3	0	2	1	0	1	0	2	0	0
	6%		**13%**		**18%**	**3%**		**5%**		**17%**	**0%**	
51-75% implementation	16	3	8	5	5	10	1	5	0	3	5	3
	30%	21%	35%	31%	45%	25%		26%		25%	36%	
26-50% implementation	13	4	5	4	2	10	1	6	1	3	3	0
	25%	29%	22%	25%	18%	25%		32%		25%	21%	
1-25% implementation	21	7	7	7	2	19	0	7	0	4	6	4
	40%	50%	30%	44%	18%	48%		37%		33%	43%	
Plans to collect cpKPI in 2017/18 (n=)	(168)	(44)	(76)	(48)	(37)	(125)	(6)	(27)	(34)	(49)	(39)	(19)
	73	17	33	23	19	51	3	17	1	21	22	12
	43%	39%	43%	48%	51%	41%		63%	3%	43%	56%	6%
Proportion of patients who received medication education from a pharmacist at discharge (n=)	(180)	(49)	(80)	51)	40)	(133)	(7)	(29)	(37)	(52)	(42)	(20)
Data collected in 2016/17	48	11	23	14	10	36	2	18	0	14	9	7
	27%	**22%**	**29%**	**27%**	**25%**	**27%**		**62%**		**27%**	**21%**	**35%**
Extent of implementing cpKPI (n=)	(48)	(11)	(23)	(14)	(10)	(36)	(2)	(18)	(0)	(14)	(9)	(7)
76-100% implementation	3	1	1	1	2	1	0	0	0	1	0	2
	6%	**9%**	**4%**	**7%**	**20%**	**3%**		**0%**		**7%**		
51-75% implementation	6	1	4	1	1	4	1	1	0	3	1	1
	13%	9%	17%	7%	10%	11%		6%		21%		
26-50% implementation	10	2	8	0	3	6	1	4	0	2	3	1
	21%	18%	35%		30%	17%		22%		14%		
1-25% implementation	29	7	10	12	4	25	0	13	0	8	5	3
	60%	64%	43%	86%	40%	69%		72%		57%		
Plans to collect cpKPI in 2017/18 (n=)	(169)	(46)	(76)	(47)	(37)	(126)	(6)	(29)	(34)	(49)	(38)	(19)
	78	16	39	23	19	56	3	20	4	27	15	12
	46%	35%	51%	49%	51%	44%		69%	12%	55%	39%	63%

Base for data collected: All respondents.
Base for extent of implementation: facilities with data collection
Note: Sorted by percentage of data collected
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Evaluation of Clinical Pharmacy Services

Changing solely for the sake of change is counterproductive. Experience has shown, and research continues to confirm, that change must be evaluated to ensure that it results in positive improvements or outcomes. With the evolution of clinical pharmacy services in hospitals, not only are robust systems for evaluation necessary, but they also provide evidence that can be used to justify the investment to healthcare administrators. With appropriately justified investments, pharmacy programs will have the right mix of human, material and financial resources for a medication management system that ensures the proper use of medications for all patients.

The 2013/14 report provided baseline data on the development of clinical services both nationally and regionally. As elements of pharmacy services change, indicators also change. CSHP's survey of facilities for the CSHP 2015 initiative, Targeting Excellence in Pharmacy Practice, gave a clear snapshot of hospital practice in 2009.[75] Some of the targeted goals and objectives were lofty, but overall, they gave guidance and direction to help optimize care for patients across the country. Following this initiative, the development of cpKPIs by the national working group[70,71] has provided important indicators for hospital practice that are specific, measurable, achievable and relevant.

The 2016/17 survey results indicate a positive trend in the evaluation of pharmacists and pharmacy services:

- 37% (66/179) reported that their facilities were collecting "other clinical pharmacy performance indicators (not cpKPIs)"; this was the first time the survey asked about collection of this type of information.
- 63% (115/182) of respondents reported that their organizations' pharmacy leadership was using a structured approach to define and prioritize pharmacists' activities, up from 50% (81/161) in 2013/14.
- In terms of the methodology used to evaluate the provision of direct patient care pharmacy services, there were increases for peer-review evaluation, from 27% (12/44) in 2013/14 to 38% (25/66) in 2016/17, and self-evaluation, from 48% (21/44) in 2013/14 to 76% (50/66) in 2016/17.
- The use of retrospective chart review has declined, from 70% (31/44) in 2013/14 to 56% (37/66) in 2016/17, with the shift to more meaningful evaluation methods.

The 2016/17 survey results indicate a positive trend in the evaluation of pharmacists and pharmacy services.

There are also opportunities in the area of evaluation:

- Only 36% (66/182) of respondents reported that their facilities were evaluating the provision of direct patient care pharmacy services.

This percentage encompasses all five methods listed in the survey: retrospective chart review, direct observation, peer-review evaluation, self-evaluation by pharmacist, and knowledge and competence testing

- Evaluation practices lagged in QC, with no respondents reporting direct observation or testing of knowledge and competence, and a few reporting the use of retrospective evaluation.
- Evaluation was reported more frequently for conformity of documentation with clinical practice (90%, 55/61) than for individualized pharmaceutical care plans (64%, 39/61), counselling and medication adherence (28%, 17/61) and drug information answers (18%, 11/61).
- Overall, 98% (181/184) of respondents replied to questions about the evaluation of clinical services.
- Only 14% (26/181) reported the presence of established mechanisms to measure patients' medication-related outcomes, and only 15% (4/26) of respondents with such mechanisms in place used the outcomes to evaluate pharmacists' performance.

Some questions remain to be answered:

- What is the role of regulatory authorities?
- Should the regulatory authorities be the sole drivers of clinical services, and if not, what are the motivators to improve clinical services and how can they be facilitated?

Table B-6 summarizes the reported approaches for the evaluation of clinical services.

Table B-6. Evaluation of Clinical Services, 2016/17

		All	Bed Size			Hospital Type			Region				
			50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
A structured approach is used to define and prioritize pharmacists activities	(n=)	(182)	(49)	(81)	(52)	(41)	(134)	(7)	(30)	(37)	(51)	(43)	(21)
		115	31	50	34	34	75	6	23	32	26	22	12
		63%	**63%**	**62%**	**65%**	**83%**	**56%**		**77%**	**86%**	**51%**	**51%**	**57%**
Other clinical pharmacy performance indicators (not cpKPI) are being collected	(n=)	(179)	(49)	(77)	(53)	(40)	(132)	(7)	(28)	(37)	(51)	(42)	(21)
		66	22	22	22	24	39	3	9	23	17	8	9
		37%	**45%**	**29%**	**42%**	**60%**	**30%**		**32%**	**62%**	**33%**	**19%**	**43%**
The provision of direct patient care pharmacy services is being evaluated	(n=)	(182)	(49)	(80)	(53)	(40)	(135)	(7)	(29)	(37)	(52)	(43)	(21)
		66	20	25	21	24	39	3	12	23	17	5	9
		36%	**41%**	**31%**	**40%**	**60%**	**29%**		**41%**	**62%**	**33%**	**12%**	**43%**
Base: All respondents													
Methods used for evaluating provision of direct patient care pharmacy services:	(n=)	(66)	(20)	(25)	(21)	(24)	(39)	(3)	(12)	(23)	(17)	(5)	(9)
self-evaluation by pharmacist		50	14	21	15	19	28	3	10	21	10	2	7
		76%	**70%**	**84%**	**71%**	**79%**	**72%**		**83%**	**91%**	**59%**		
retrospective chart review		37	13	15	9	10	24	3	7	17	7	3	3
		56%	**65%**	**60%**	**43%**	**42%**	**62%**		**58%**	**74%**	**41%**		
direct observation		33	11	13	9	14	17	2	5	17	7	0	4
		50%	**55%**	**52%**	**43%**	**58%**	**44%**		**42%**	**74%**	**41%**		
peer-review evaluation		25	6	11	8	10	14	1	6	5	9	2	3
		38%	**30%**	**44%**	**38%**	**42%**	**36%**		**50%**	**22%**	**53%**		
other		12	6	3	3	5	6	1	0	6	1	1	4
		18%	**30%**	**12%**	**14%**	**21%**	**15%**		**0%**	**26%**	**6%**		
knowledge and competence testing		5	2	1	2	1	4	0	0	1	3	0	1
		8%	**10%**	**4%**	**10%**	**4%**	**10%**		**0%**	**4%**	**18%**		
Base: Facilities where the provision of direct patient care pharmacy services is evaluated ***Note: multiple mentions permitted***													
Aspects of clinical practice evaluated:	(n=)	(61)	(18)	(25)	(18)	(21)	(37)	(3)	(9)	(21)	(17)	(5)	(9)
conformity of documentation with clinical practice		55	16	22	17	20	32	3	7	20	15	5	8
		90%	**89%**	**88%**	**94%**	**95%**	**86%**			**95%**	**88%**		
development of an individualized pharmaceutical care plan		39	13	16	10	13	23	3	8	19	8	2	2
		64%	**72%**	**64%**	**56%**	**62%**	**62%**			**90%**	**47%**		
medication counselling and evaluation of adherence		17	7	6	4	4	12	1	3	2	6	1	5
		28%	**39%**	**24%**	**22%**	**19%**	**32%**			**10%**	**35%**		
answers to drug information questions		11	4	2	5	3	7	1	0	2	4	2	3
		18%	**22%**	**8%**	**28%**	**14%**	**19%**			**10%**	**24%**		
Base: Facilities where the provision of direct patient care pharmacy services is evaluated ***Note: multiple mentions permitted***													
Mechanisms have been established to measure patients' medication-related outcomes	(n=)	(181)	(49)	(79)	(53)	(40)	(134)	(7)	(28)	(37)	(52)	(43)	(21)
		26	6	9	11	9	17	0	0	2	16	5	3
		14%	**12%**	**11%**	**21%**	**23%**	**13%**		**0%**	**5%**	**31%**	**12%**	**14%**
Base: All respondents													
Those outcomes are used to evaluate the performance of pharmacists	(n=)	(26)	(6)	(9)	(11)	(9)	(17)	(0)	(0)	(2)	(16)	(5)	(3)
		4	1	1	2	1	3	0	0	0	2	1	1
		15%			**18%**		**18%**				**13%**		

Base: Facilities with mechanisms to measure patients' medication-related outcomes
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

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C - Drug Distribution Systems

Kyle MacNair and Allan Mills

The practice of drug distribution in Canadian healthcare institutions continues to evolve, with the introduction of new standards, the adoption and implementation of new technology and the integration of regulated pharmacy technicians into patient care teams in many jurisdictions. The goal of this evolution is to create a system that delivers medications in a safe, accountable and cost-effective manner.

Oral Medication Systems

Twenty years ago, when the 1997/98 Hospital Pharmacy in Canada Report was published, drug distribution by hospital pharmacies looked very different from how it looks today. At that time, more than three-quarters of hospitals employed a traditional dispensing system, and only seven hospitals in the country had incorporated unit-based automated dispensing systems in the care of their patients. Over the past two decades, there has been a complete reversal of this pattern, with traditional dispensing now occurring in only a handful of facilities across the country. This shift has been driven by the recognition that automated drug distribution and the administration of drugs in ready-to-use unit-dose packaging reduce medication errors and improve patient safety. This knowledge has led Accreditation Canada to make medication dispensing in unit-dose packaging a high priority within its *Managing Medication Standards*.[1]

Unit-Dose Systems

- Centralized unit-dose systems, in which unit-dose medications are dispensed from a central pharmacy, were reported by 77% (140/181) of all respondents in 2016/17 (Table C-1). This represents a slight increase from 75% (118/157) in 2013/14 and reflects the steady adoption of centralized unit-dose systems since 2007/08, when such systems were reported by 64% (103/162) of respondents.

The percentage of respondents employing unit-dose systems has increased over the past five survey periods.

- Centralized unit-dose systems were reported to be in use by all respondent facilities in Quebec (QC) (100%, 43/43), but were less commonly seen in other regions: 86% (25/29) in British Columbia/Yukon (BC/YT), 73% (37/51) in Ontario (ON), 57% (12/21) in the Atlantic provinces and 62% (23/37) in the Prairie provinces. [The Atlantic provinces comprise New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PE) and Newfoundland and Labrador (NL). The Prairie provinces comprise Alberta (AB), Saskatchewan (SK) and Manitoba (MB).]

Use of decentralized unit-dose systems from satellite pharmacies has almost doubled since 2013/14.

- Decentralized unit-dose systems that involve dispensing of unit-dose medications from a satellite pharmacy were reported to be in use by 15% (28/181) of all respondents (Table C-1). This is almost double the 8% (12/157) rate reported for 2013/14. Decentralized unit-dose drug distribution from satellite pharmacies was more commonly reported by respondents in QC (23%, 10/43), the Prairies (16%, 6/37) and ON (14%, 7/51) than in the Atlantic provinces (14%, 3/21) or BC/YT (7%, 2/29).

- The use of decentralized unit-dose systems in which unit-dose medications are provided from automated dispensing cabinets (ADCs) located in patient care areas that service overnight beds (i.e., not including the emergency department [ED], operating rooms [OR] and other outpatient locations), was reported by 56% (102/181) of all respondents. The provision of medication from ADCs varied across regions, being more common in the Atlantic provinces (71%, 15/21), ON (65%, 33/51) and BC/YT (59%, 17/29) than in QC (49%, 21/43) or the Prairies (43%, 16/37). Uptake of decentralized unit-dose systems in ON was markedly increased from the 48% (19/40) reported for 2013/14.

Traditional and Total Wardstock Systems

The overall trend of dwindling use of traditional and total wardstock systems in favour of centralized and decentralized unit-dose systems continued in 2016/17. Since 2009/10, the use of traditional drug distribution systems has dropped from 35% (55/158) of facilities to 18% (32/181) in 2016/17. Regional variability was prominent in the application of older distribution systems.

- For traditional systems, the highest response rate was reported for BC/YT (38%, 11/29) and the lowest for QC (7%, 3/43).

- For total wardstock systems, the highest response rate was reported for the Atlantic provinces (33%, 7/21) and the lowest, once again, for QC (12%, 5/43).

Table C-1. Drug Distribution Systems, 2016/17 (Percentage of Respondents Using Various Drug Distribution Systems for Patient Care Areas with Inpatient Beds)

	All	Hospital Type			Region				
		Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
(n = all facilities with acute or non-acute care beds)	*(181)*	*(41)*	*(133)*	*(7)*	*(29)*	*(37)*	*(51)*	*(43)*	*(21)*
(n = all facilities with acute care beds)	*(181)*	*(41)*	*(133)*	*(7)*	*(29)*	*(37)*	*(51)*	*(43)*	*(21)*
(n = facilities with non-acute care beds)	*(110)*	*(15)*	*(93)*	*(2)*	*(15)*	*(11)*	*(37)*	*(32)*	*(15)*
Unit dose system - centralized	140	33	102	5	25	23	37	43	12
	77%	**80%**	**77%**		**86%**	**62%**	**73%**	**100%**	**57%**
Used for acute care beds	138	32	101	5	24	23	37	43	11
	76%	**78%**	**76%**		**83%**	**62%**	**73%**	**100%**	**52%**
Used for non-acute care beds	84	11	72	1	12	6	25	32	9
	76%	**73%**	**77%**		**80%**	**55%**	**68%**	**100%**	**60%**
Unit dose system - decentralized from pharmacy satellites	28	12	13	3	2	6	7	10	3
	15%	**29%**	**10%**		**7%**	**16%**	**14%**	**23%**	**14%**
Used for acute care beds	24	12	9	3	2	6	6	7	3
	13%	**29%**	**7%**		**7%**	**16%**	**12%**	**16%**	**14%**
Used for non-acute care beds	8	0	8	0	0	0	3	3	2
	7%	**0%**	**9%**		**0%**	**0%**	**8%**	**9%**	**13%**
Unit dose system - decentralized from automated dispensing cabinets	102	27	72	3	17	16	33	21	15
	56%	**66%**	**54%**		**59%**	**43%**	**65%**	**49%**	**71%**
Used for acute care beds	102	27	72	3	17	16	33	21	15
	56%	**66%**	**54%**		**59%**	**43%**	**65%**	**49%**	**71%**
Used for non-acute care beds	37	7	29	1	2	2	23	3	7
	34%	**47%**	**31%**		**13%**	**18%**	**62%**	**9%**	**47%**
Traditional drug distribution system	34	7	27	0	11	6	10	3	4
	19%	**17%**	**20%**		**38%**	**16%**	**20%**	**7%**	**19%**
Used for acute care beds	32	6	26	0	11	6	9	3	3
	18%	**15%**	**20%**		**38%**	**16%**	**18%**	**7%**	**14%**
Used for non-acute care beds	16	2	14	0	4	2	5	2	3
	15%	**13%**	**15%**		**27%**	**18%**	**14%**	**6%**	**20%**
Total wardstock system	32	6	26	0	6	5	9	5	7
	18%	**15%**	**20%**		**21%**	**14%**	**18%**	**12%**	**33%**
Used for acute care beds	28	6	22	0	4	5	9	3	7
	15%	**15%**	**17%**		**14%**	**14%**	**18%**	**7%**	**33%**
Used for non-acute care beds	16	3	13	0	3	0	5	4	4
	15%	**20%**	**14%**		**20%**	**0%**	**14%**	**13%**	**27%**
Controlled/carded dose system	16	2	14	0	2	5	1	5	3
	9%	**5%**	**11%**		**7%**	**14%**	**2%**	**12%**	**14%**
Used for acute care beds	7	0	7	0	0	3	1	2	1
	4%	**0%**	**5%**		**0%**	**8%**	**2%**	**5%**	**5%**
Used for non-acute care beds	12	2	10	0	2	3	0	4	3
	11%	**13%**	**11%**		**13%**	**27%**	**0%**	**13%**	**20%**

Base: Respondents with complete answers to questions about drug distribution systems
Note: multiple mentions permissible
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

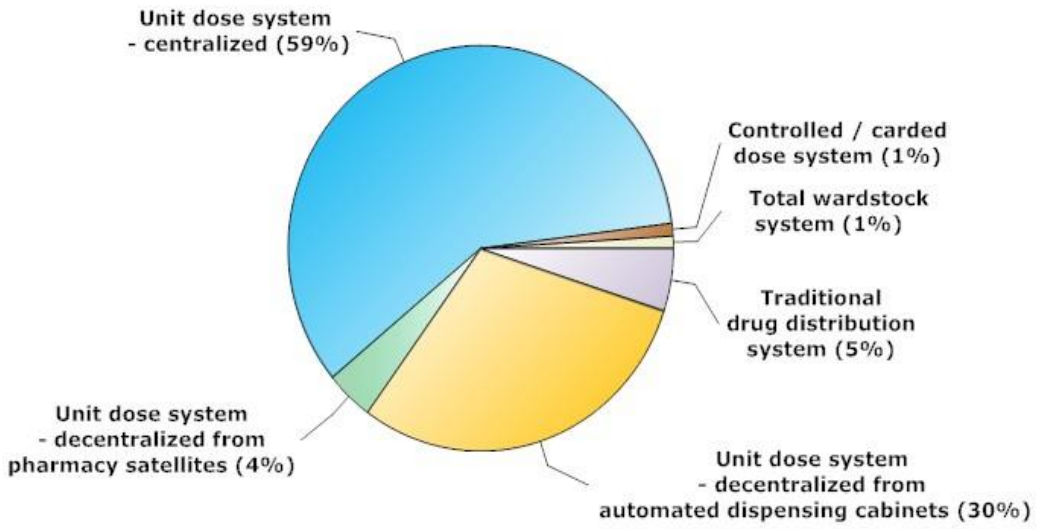
In the United States, the trend toward greater use of decentralized distribution systems as the primary method of medication delivery has continued, as noted in the report from the 2013 national survey of dispensing and administration practices in hospital pharmacy by the American Society of Health-Systems Pharmacists (ASHP).[2] Among respondents to that survey, 63.5% indicated that their structure for pharmacy distribution systems was decentralized through ADCs, and 35.6% reported using a centralized system (unit dose, robotic or carousel).[2] There was no reported use of traditional or total wardstock systems.

Distribution Systems by Bed Type

The trend of reduced utilization of traditional dispensing systems is even more pronounced when the percentage of beds serviced by the various systems is analyzed. On average, only 5% of acute care beds were reported to be serviced by a traditional drug distribution system (Figure C-1), down from 11% in 2013/14.

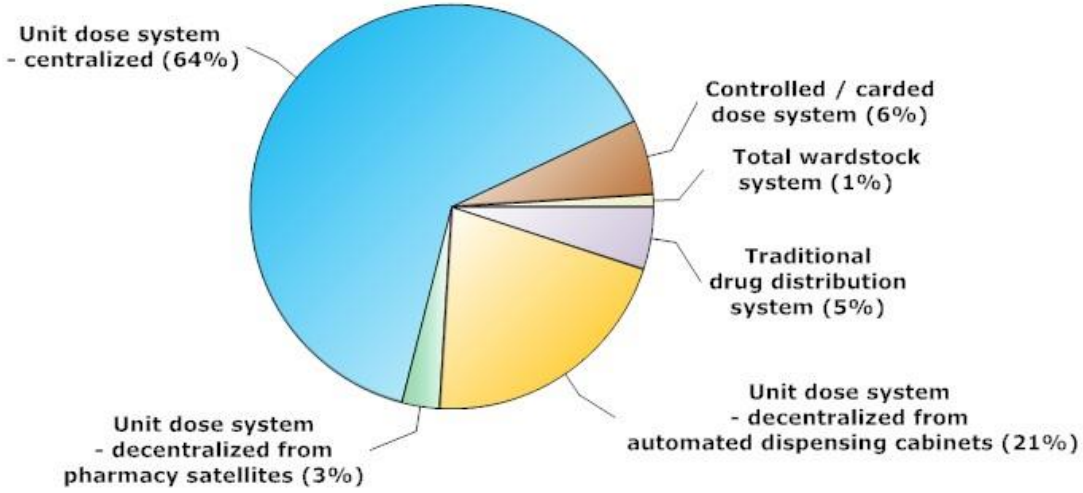
Figure C-1. Drug Distribution Systems – Average Percentage of Beds, 2016/17

Acute Care Beds



Base: Respondents with complete answers to questions about acute drug distribution systems (n=181)

Non-acute Care Beds



Base: Respondents with complete answers to questions about non-acute drug distribution systems (n=110)

There was some regional variation in the percentage of acute care beds that received the majority of scheduled oral doses via a centralized or decentralized unit-dose system or via a controlled/carded dose system. The use of these systems was almost universal in QC (99% of acute care beds), ON (98%), and the Atlantic provinces (96%). These unit-dose systems were also used for large proportions of acute care beds in other regions: 85% in BC/YT and 87% in the Prairies. The near-universal adoption of automated distribution in QC can be traced back to a program of the province's Department of Health and Social Services, known as Systèmes Automatisés et Robotisés de la Distribution des Médicaments (SARDM), which aimed to increase the adoption of automated and robotic technologies to improve patient care.[3]

Overall, 99% of acute care beds in Quebec receive the majority of scheduled oral doses via a unit-dose system.

Automated Dispensing Cabinets

- The use of ADCs in any location within the hospital, either as part of a unit-dose dispensing system or as a method of controlling access to certain medications (such as narcotic medications in operating rooms), was reported by 80% (147/184) of respondents, up from 71% (114/161) in 2013/14.

Use of automated dispensing cabinets increased from 71% to 80% since 2013/14.

The rise in the use of ADCs has been occurring at the same time as substantial consolidation within the ADC market. The greater limitation on product options now available may lead to cost or service-level challenges that will affect future uptake of this technology.

- On a regional basis, the use of ADCs was most commonly reported in QC (98%, 41/42), followed by the Atlantic provinces (90%, 19/21), ON (88%, 46/52), BC/YT (63%, 19/30) and the Prairies (61%, 23/38). Teaching hospitals (90%, 37/41) and pediatric hospitals (6/7) were more likely to have ADCs than non-teaching hospitals (78%, 105/135). Similarly, facilities with more than 500 beds reported ADCs more often (90%, 47/52) than facilities with 201–500 beds (78%, 63/81) and those with 50–200 beds (76%, 38/50).

Table C-2 shows the reported locations of ADCs among respondents who reported use of these devices.

- For the fourth consecutive survey, the ED was the most common location for ADCs, reported by 99% (146/147) of respondents with ADCs, an increase from 96% (109/113) in 2013/14, 91% (94/103) in 2011/12 and 94% (79/84) in 2009/10. Adult critical care units remained the second most common location for ADCs, reported by 87% (128/147) of respondents with ADCs, unchanged from 2013/14. The third most common location was general adult medical/surgical units, reported by 79% (116/147) of facilities, up from 73% (83/113) in 2013/14.

Table C-2. Automated Dispensing Cabinets Use and Access, 2016/17

Location of Automated Dispensing Cabinets		Medications Accessed from ADCs	Patient Specific Profiles are Used to Control Access
General adult medical/surgical units	(n=)	(147) 116 **79%**	(113) 105 **93%**
Adult critical care units	(n=)	(147) 128 **87%**	(124) 107 **86%**
Operating rooms	(n=)	(147) 77 **52%**	(73) 7 **10%**
Recovery rooms	(n=)	(147) 86 **59%**	(80) 17 **21%**
Labor and delivery units	(n=)	(147) 76 **52%**	(74) 44 **59%**
Ante-partum/post-partum units	(n=)	(147) 71 **48%**	(68) 58 **85%**
Mental health units	(n=)	(147) 92 **63%**	(89) 83 **93%**
Emergency departments	(n=)	(147) 146 **99%**	(138) 65 **47%**
General pediatric medical/surgical units	(n=)	(147) 71 **48%**	(68) 62 **91%**
Pediatric critical care units	(n=)	(147) 35 **24%**	(34) 26 **76%**

Base for "Medications accessed from ADCs": Facilities with automated dispensing cabinets (n= 147)
Base for "Where patient specific profiles are used to control access": Facilities using automated dispensing cabinets at that location

- There was a great deal of regional variability in ADC location. In general, respondents from BC/YT and ON reported higher breadth of ADC placement, (located in almost every patient care area) than respondents from other regions. Despite the overall high use of ADC in QC, respondents from QC indicated that the breadth of ADC placement was relatively low compared to BC/YT and ON, but similar to the Prairies. Responses from the Atlantic provinces were mixed, with the highest rate of use of ADCs in adult critical care units and general adult medical/surgical units in the country (both 95%, 18/19), but also the second-lowest rate of use of ADCs in the operating room (42%, 8/19).

Respondents using ADCs were asked whether patient-specific medication profiles were used to control access to medications contained in those cabinets (Table C-2).

- Although short-stay units, such as operating rooms and recovery rooms, continued to have lower rates than other patient care areas, with 10% (7/73) and 21% (17/80) of respondents, respectively, reporting the use of patient-specific profiles to access medications, the use of such profiles by these units has increased from 2013/14 (3%, 2/61, and 12%, 7/60, respectively). The primary role of ADCs in these areas is for secured storage and monitored access to medications, but there appears to be a shift to using the patient profile to add another level of safety.

Robotic Automation

According to the 2013 ASHP survey,[2] 8% of general and children's medical/surgical hospitals used a robotic distribution system that automated the dispensing of unit-dose inpatient medications in a centralized distribution system, representing a reduction from the 11% utilization documented in the 2011 ASHP survey.[4]

- In Canada, the use of robotic automation to select and fill patient-specific unit-dose bins has remained steady relative to the previous two reports: 12% (22/183) of all respondents in 2016/17, 12% (19/161) in 2013/14 and 13% (22/169) in 2011/12. In 2016/17, these robotic dispensing systems were reported more often by respondents from teaching hospitals (24%, 10/41) than pediatric hospitals (1/7) or non-teaching hospitals (8%, 11/135). In terms of hospital size, robotic systems were reported more often by facilities with more than 500 beds (17%, 9/52) or 201–500 beds (15%, 12/81) than by facilities with 50–200 beds (2%, 1/50). On a regional basis, utilization was reported most often by respondents from ON (21%, 11/52) and QC (19%, 8/42).

Pharmacy Hours of Operation

- Respondents indicated that the hospital pharmacy was open an average of 84 hours/week, 5 hours more than the average 79 hours reported for 2013/14. Pediatric hospitals (120 hours/week), teaching hospitals (105 hours/week) and facilities with more than 500 beds (100 hours/week) had the highest weekly averages (Table C-3).

In 2016/17, pediatric hospitals were open an average of 120 hours per week, 14% more than the average for teaching hospitals and 58% more than the average for non-teaching hospitals.

- Eleven respondents reported that their pharmacies were open 168 hours/week (i.e., 24 hours/day, 7 days/week), up from 2 respondents in 2011/12 (data for this measure were not collected in 2013/14).

The number of facilities open 24/7 increased five-fold from the 2011/12 survey.

Table C-3. Pharmacy Hours of Operation, 2016/17

		All	Hospital Type			Region				
			Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Average number of hours per week that pharmacy was open	(n=)	(180)	(40)	(133)	(7)	(29)	(38)	(52)	(42)	(19)
		84	**105**	**76**	**120**	**85**	**88**	**90**	**80**	**71**
Pharmacy is open 168 hours/week	(n=)	(184)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
		11	6	3	2	2	4	5	0	0
		6%	**15%**	**2%**		**7%**	**11%**	**10%**	**0%**	**0%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Medication Order Entry and Verification

Entry of medication orders into the pharmacy information system continues to be performed most frequently by pharmacists and pharmacy technicians (Table C-4).

Table C-4. Medication Order Entry and Verification, 2016/17

		All	Hospital Type			Region				
			Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Order entry performed by prescribing physicians, entering their own orders	(n=)	(184)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
		33	13	18	2	1	6	19	4	3
		18%	**32%**	**13%**		**3%**	**16%**	**37%**	**9%**	**14%**
Verification of order entry by prescribing physicians is done by:	(n=)	(33)	(13)	(18)	(2)	(1)	(6)	(19)	(4)	(3)
A pharmacist only		27	10	16	1	1	1	19	3	3
		82%	**77%**	**89%**				**100%**		
A pharmacy technician only		3	3	0	0	0	3	0	0	0
		9%	**23%**	**0%**				**0%**		
Either a pharmacist or a pharmacy technician		3	0	2	1	0	2	0	1	0
		9%	**0%**	**11%**				**0%**		
Verification of order entry is not required		0	0	0	0	0	0	0	0	0
		0%	**0%**	**0%**				**0%**		
Order entry performed by prescribing pharmacists, entering their own orders	(n=)	(184)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
		37	10	25	2	5	10	10	8	4
		20%	**24%**	**18%**		**17%**	**26%**	**19%**	**19%**	**19%**
Verification of order entry by prescribing pharmacists is done by:	(n=)	(36)	(10)	(24)	(2)	(5)	(10)	(9)	(8)	(4)
A pharmacist only		21	4	16	1	4	2	6	6	3
		58%	**40%**	**67%**			**20%**			
A pharmacy technician only		4	3	1	0	0	3	1	0	0
		11%	**30%**	**4%**			**30%**			
Either a pharmacist or a pharmacy technician		4	0	3	1	0	3	1	0	0
		11%	**0%**	**13%**			**30%**			
Verification of order entry is not required		7	3	4	0	1	2	1	2	1
		19%	**30%**	**17%**			**20%**			
Order entry performed by pharmacists, entering prescribers orders	(n=)	(184)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
		131	28	97	6	22	29	42	21	17
		71%	**68%**	**71%**		**73%**	**76%**	**81%**	**49%**	**81%**
Verification of order entry by pharmacists, entering prescribers' orders, is done by:	(n=)	(126)	(28)	(92)	(6)	(22)	(28)	(42)	(19)	(15)
A pharmacist only		67	16	46	5	10	15	17	14	11
		53%	**57%**	**50%**		**45%**	**54%**	**40%**	**74%**	**73%**
A pharmacy technician only		2	0	2	0	0	0	2	0	0
		2%	**0%**	**2%**		**0%**	**0%**	**5%**	**0%**	**0%**
Either a pharmacist or a pharmacy technician		17	3	13	1	1	4	9	2	1
		13%	**11%**	**14%**		**5%**	**14%**	**21%**	**11%**	**7%**
Verification of order entry is not required		40	9	31	0	11	9	14	3	3
		32%	**32%**	**34%**		**50%**	**32%**	**33%**	**16%**	**20%**
Order entry performed by pharmacy technicians, entering prescribers' orders	(n=)	(184)	(41)	(136)	(7)	(30)	(38)	(5)2	(43)	(21)
		139	32	103	4	27	23	28	43	18
		76%	**78%**	**76%**		**90%**	**61%**	**54%**	**100%**	**86%**
Verification of order entry by pharmacy technicians, entering prescribers orders, is done by:	(n=)	(136)	(32)	(100)	(4)	(27)	(22)	(28)	(41)	(18)
A pharmacist only		114	24	88	2	27	16	16	39	16
		84%	**75%**	**88%**		**100%**	**73%**	**57%**	**95%**	**89%**
A pharmacy technician only		7	4	3	0	0	3	4	0	0
		5%	**13%**	**3%**		**0%**	**14%**	**14%**	**0%**	**0%**
Either a pharmacist or a pharmacy technician		11	3	6	2	0	3	5	2	1
		8%	**9%**	**6%**		**0%**	**14%**	**18%**	**5%**	**6%**
Verification of order entry is not required		4	1	3	0	0	0	3	0	1
		3%	**3%**	**3%**		**0%**	**0%**	**11%**	**0%**	**6%**
Order entry performed by other prescribers (e.g. nurse prescribers)	(n=)	(184)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
		28	10	17	1	2	9	12	3	2
		15%	**24%**	**13%**		**7%**	**24%**	**23%**	**7%**	**10%**
Verification of order entry by other prescribers (e.g. nurse prescribers) is done by:	(n=)	(28)	(10)	(17)	(1)	(2)	(9)	(12)	(3)	(2)
A pharmacist only		21	7	14	0	2	4	11	2	2
		75%	**70%**	**82%**				**92%**		
A pharmacy technician only		4	3	1	0	0	3	1	0	0
		14%	**30%**	**6%**				**8%**		
Either a pharmacist or a pharmacy technician		3	0	2	1	0	2	0	1	0
		11%	**0%**	**12%**				**0%**		
Verification of order entry is not required		0	0	0	0	0	0	0	0	0
		0%	**0%**	**0%**				**0%**		

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

- Among respondents to the 2016/17 survey, 76% (139/184) indicated that prescribers' medication orders were entered into the pharmacy information system by pharmacy technicians, similar to levels reported in 2013/14 (78%, 126/161) and in 2011/12 (79%, 133/169). In addition, 71% (131/184) of respondents indicated that pharmacists entered prescribers' medication orders, similar to levels reported in 2013/14 (71%, 114/161) and 2011/12 (72%; 122/169).

- Entry of medication orders into the pharmacy information system by prescribing physicians was reported by 18% (33/184) of respondents, an increase from the 14% (23/161) reported in 2013/14. Order entry by prescribing pharmacists was unchanged in 2016/17, at 20% (37/184), compared with 19% (30/161) in 2013/14. Order entry by prescribing physicians was highest in ON (37%, 19/52), more than twice the rate reported for the next highest region (Prairies: 16%, 6/38).

The finding that order entry by prescribing pharmacists has not changed since 2013/14 was somewhat of a surprise, considering the expansion of the scope of pharmacy practice in most Canadian provinces to include adaptation of medication orders and more independent prescribing.

The 2016/17 survey included a new option to document the frequency of order entry performed by "other prescribers" with the opportunity to enter free-text details as to the qualifications of those prescribers.

- Overall, 15% (28/184) of respondents reported that other prescribers performed medication order entry. The professionals identified as "other prescribers" included nurse practitioners, physician assistants, and nurses/pharmacists operating under medical directives.

- For orders entered by prescribing physicians, respondents reported that verification was most frequently performed by a pharmacist (82%, 27/33) (Table C-4). For orders entered by prescribing pharmacists, 19% (7/36) of respondents reported that no additional verification was required, about half the 44% (12/27) reported in 2013/14. Respondents reported that pharmacy technicians infrequently verified medication order entry, although this practice had increased across all groups of prescribers relative to the 2013/14 report.

Pharmacists verify the majority of orders entered in the pharmacy computerized information system.

- There was substantial regional variation in medication order entry by pharmacy technicians: 54% (28/52) of respondents in ON, 61% (23/38) of those in the Prairies, 86% (18/21) of those in the Atlantic region, 90% (27/30) of those in BC/YT and 100% of those in QC (43/43). Overall, medication orders entered by pharmacy technicians were reported to be verified by pharmacists in 84% (114/136) of facilities, with very few respondents indicating no requirement for verification of order entry by pharmacy technicians.

- For facilities where pharmacists enter prescribers' orders, 32% (40/126) of respondents reported that verification of order entry was not required, down from 51% (57/112) in 2013/14

For both prescribing pharmacists and pharmacists entering other prescribers' orders, the proportion of respondents reporting that verification of order entry was not required declined from 2013/14.

Compared with the modest uptake of computerized practitioner (or physician) order entry (CPOE) in the Canadian market, the 2016 ASHP survey showed continued rapid progress in this area in the United States.[5] This most recent iteration of the ASHP survey indicated that medication orders were received electronically in the pharmacy through CPOE at 90.7% of responding facilities, with digital image capture (4.2%), fax (2.8%) and handwritten orders (2.3%) accounting for the remainder. In contrast, just 10 years ago, the 2007 ASHP survey found that CPOE was used for communication with the pharmacy by only 5.1% of respondents.[5]

- Among respondents to the 2016/17 Canadian survey, 95% (164/172) reported that, during the hours that the pharmacy is open, a pharmacist reviews at least 95% of all routine medication orders for therapeutic appropriateness before the medications are dispensed from the central or a satellite pharmacy (Table C-5). This is similar to the 93% (156/168) reported for 2011/12. In addition, 70% (102/145) reported that this type of review occurred before medications were accessed from ADCs on patient care units, up substantially from the 44% (74/168) reported for 2011/12.

- In terms of medication review during the hours that the pharmacy is closed, only 3% (4/153) of respondents reported that a pharmacist, either on call or working off site, reviewed at least 95% of all routine medication orders for therapeutic appropriateness before medications were accessed from a night cupboard or similar device for after-hours supply, or from ADCs on the patient care units. This rate is consistent with a very low rate reported for 2011/12.

- About one-fifth of respondents (18%, 28/156) reported that during the hours that the pharmacy is closed, a pharmacist reviews at least 95% of all routine medication orders for therapeutic appropriateness before the orders appear on patients' medication administration records (MARs). There was substantial regional variation in this measure, ranging from 39% (9/23) of respondents in BC/YT to 5% (2/38) in QC.

Table C-5. Pharmacist Review of Medication Orders when the Pharmacy is Open or Closed, 2016/17

		All	Hospital Type			Region				
			Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
When the pharmacy is closed, does a staff or contract pharmacist review at least 95% of all orders for appropriateness?										
... before medications are accessed from a night cupboard or similar after hours medication supply mechanism (e.g., DocuMed system)	(n=)	(153)	(30)	(119)	(4)	(26)	(33)	(38)	(37)	(19)
		4	1	2	1	0	2	2	0	0
		3%	**3%**	**2%**		**0%**	**6%**	**5%**	**0%**	**0%**
... before medications are accessed from automated dispensing cabinets on the patient care units	(n=)	(131)	(29)	(98)	(4)	(17)	(21)	(38)	(37)	(18)
		4	0	4	0	0	0	4	0	0
		3%	**0%**	**4%**		**0%**	**0%**	**11%**	**0%**	**0%**
... before medications are accessed from wardstock	(n=)	(149)	(30)	(115)	(4)	(25)	(33)	(35)	(37)	(19)
		1	0	1	0	0	0	1	0	0
		1%	**0%**	**1%**		**0%**	**0%**	**3%**	**0%**	**0%**
... before medication order appears on the medication administration record (MAR)	(n=)	(156	(31)	(121)	(4)	(23)	(33)	(42)	(38)	(20)
		28	8	18	2	9	6	7	2	4
		18%	**26%**	**15%**		**39%**	**18%**	**17%**	**5%**	**20%**
Base: Facilities where pharmacy is not open 168 hrs/wk										
When the pharmacy is open, does a pharmacist review at least 95% of all routine medication orders.										
... before medications are dispensed from the central or a satellite pharmacy	(n=)	(172)	(39)	(126)	(7)	(27)	(38)	(48)	(40)	(19)
		164	38	119	7	24	37	45	40	18
		95%	**97%**	**94%**		**89%**	**97%**	**94%**	**100%**	**95%**
... before medications are accessed from automated dispensing cabinets on the patient care units	(n=)	(145)	(36)	(103)	(6)	(18)	(22)	(46)	(41)	(18)
		102	24	73	5	8	17	28	37	12
		70%	**67%**	**71%**		**44%**	**77%**	**61%**	**90%**	**67%**
... before medications are accessed from wardstock	(n=)	(163)	(37)	(121)	(5)	(26)	(37)	(44)	(39)	(17)
		71	15	51	5	2	15	20	26	8
		44%	**41%**	**42%**		**8%**	**41%**	**45%**	**67%**	**47%**
... before medication order appears on the medication administration record (MAR)	(n=)	(174)	(38)	(129)	(7)	(27)	(38)	(49)	(40)	(20)
		112	25	81	6	21	14	30	37	10
		64%	**66%**	**63%**		**78%**	**37%**	**61%**	**93%**	**50%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

In the 2013 ASHP survey of hospital pharmacy directors, 81.2% of respondents indicated that all medication orders, regardless of when they were written, were reviewed by a pharmacist before being acted upon, either through 24-hour on-site staffing (40.2%), by a national or regional telepharmacy service (20.5%), by an affiliated hospital with 24-hour service (14.5%) or through provision of order review and entry by an on-call employee pharmacist (3.4%).[2] Despite the fact that standards are in place in both Canada (standard 15.0 of the *Medication Management Standards*)[1] and the United States (standard MM 4.10 of the 2005 accreditation manual of the Joint Commission on the Accreditation of Healthcare Organizations)[6] requiring that medication orders be reviewed for appropriateness before medications are dispensed or removed from a storage area or ADC, there is wide variation in after-hours pharmacy access. However, the marked increase in the number of 24-hour hospital pharmacy operations reported in this survey (from 2 in 2011/12 to 11 in 2016/17) seems to indicate that Canada is beginning to improve in this area.

Medication Administration Records

- The manual preparation of some or all MARs was reported by 30% (54/183) of respondents (Table C-6), an increase from the 26% (44/169) reported in 2011/12 and a change from the downward trend in manual MAR preparation since 2004. None of the pediatric hospitals reported manual preparation of MARs.

- Overall, 71% (130/183) of respondents reported that MARs were generated in hard copy through the pharmacy information system (PIS), and 23% (43/183) reported that MARs were electronic, sharing a common database with the PIS, with online documentation (Table C-6). The latter represents a substantial increase from the 10% (16/169) of respondents who reported electronic/online documentation in 2011/12.

Table C-6. Medication Administration Records, 2016/17

	All	Hospital Type			Region				
		Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Medication administration records (MARs) ... (n=)	(183)	(41)	(135)	(7)	(30)	(38)	(52)	(42)	(21)
... are prepared manually	54	10	44	0	8	22	16	1	7
	30%	**24%**	**33%**		**27%**	**58%**	**31%**	**2%**	**33%**
... are generated in hard copy through the PIS, documentation of administered doses done manually	130	26	99	5	27	21	28	40	14
	71%	**63%**	**73%**		**90%**	**55%**	**54%**	**95%**	**67%**
... are electronically derived from database aligned with PIS, electronic documentation of administered doses	43	14	26	3	3	8	23	5	4
	23%	**34%**	**19%**		**10%**	**21%**	**44%**	**12%**	**19%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Parenteral Admixture Infrastructure and Policy

A thorough analysis of parenteral admixture services was presented in the 2013/14 report and will be repeated in the next iteration of the Hospital Pharmacy in Canada Survey. Questions on this topic in the 2016/17 survey focused on compliance with evolving regulatory requirements in Canada. As a result of patient safety events arising from deficiencies in sterile compounding practices in the United States[7] and Canada,[8] the National Association of Pharmacy Regulatory Authorities (NAPRA) developed broad-reaching standards for hazardous[9] and non-hazardous[10] sterile compounding, adapted from standards originally developed in QC.[11] The QC standards were, in turn, largely based on the United States Pharmacopeia (USP) General Chapter <797> and General Chapter <800> standards, which apply to non-hazardous and hazardous sterile compounding, respectively.[12,13]

Provision of Sterile Compounding

- Respondents indicated that the pharmacy department or organization was the primary provider of both non-hazardous (84%, 155/184) and hazardous (92%, 170/184) sterile compounding services (Table C-7).

- Use of an external agency as the primary provider of sterile compounding services was reported by only 5% (9/184) of respondents for non-hazardous preparations and 1% (2/184) for hazardous preparations. Notably, of the 9 respondents indicating use of an external provider for non-hazardous sterile compounding services, 6 were from ON.

- All seven of the pediatric hospitals reported that the pharmacy department or organization was primarily responsible for both hazardous and non-hazardous sterile compounding services.

Table C-7. Primary Provider of Sterile Compounding Services, 2016/17

	All	Hospital Type			Region				
		Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Sterile compounding services for non-hazardous medications ... (n=)	(184)	(41)	(136)	(7)	(30)	(38)	(5)2	(43)	(21)
... are primarily provided by the pharmacy department or organization	155	39	109	7	28	30	41	41	15
	84%	**95%**	**80%**		**93%**	**79%**	**79%**	**95%**	**71%**
... are primarily provided by an external provider	9	2	7	0	1	1	6	1	0
	5%	**5%**	**5%**		**3%**	**3%**	**12%**	**2%**	**0%**
... are not provided (admixture is done in patient care areas by non-pharmacy staff)	20	0	20	0	1	7	5	1	6
	11%	**0%**	**15%**		**3%**	**18%**	**10%**	**2%**	**29%**
Sterile compounding services for hazardous medications ... (n=)	(184)	(41)	(136)	(7)	(30)	(38)	(52)	(43)	(21)
... are primarily provided by the pharmacy department or organization	170	40	123	7	29	34	48	39	20
	92%	**98%**	**90%**		**97%**	**89%**	**92%**	**91%**	**95%**
... are primarily provided by an external provider	2	0	2	0	0	0	1	1	0
	1%	**0%**	**1%**		**0%**	**0%**	**2%**	**2%**	**0%**
... are not required for our patient population	12	1	11	0	1	4	3	3	1
	7%	**2%**	**8%**		**3%**	**11%**	**6%**	**7%**	**5%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Compliance with Standards: Non-Hazardous Compounding

The specific compounding standards assessed in the 2016/17 survey do not comprehensively represent all of the requirements outlined in the NAPRA documents, but instead focus on a number of the key infrastructure and policy-based requirements, thus indicating the degree of progress with compliance.

- The use of a biological safety cabinet or laminar airflow hood for sterile compounding of non-hazardous preparations was reported by 95% (148/155) of respondents, but only 52% (80/155) reported that their non-hazardous compounding environment included a segregated ISO class 8 ante-room (Table C-8).
- Overall, there was greater compliance with all physical space requirements in pediatric hospitals than in teaching and non-teaching hospitals.
- In regional terms, respondents from QC indicated much greater compliance with physical space requirements than respondents from any other region, with 100% (41/41) compliance for four of the five requirements, and only one respondent reporting non-compliance for the fifth requirement (positive pressure). In contrast, in the Atlantic provinces, less than half of respondents reported compliance with requirements to use segregated ISO class 7 clean rooms (40%, 6/15) and segregated ISO class 8 ante-rooms (27%, 4/15).
- Reported compliance with requirements for standard operating procedures was lower than compliance with physical space requirements, with 13% (20/152) of respondents reporting that they met none of these requirements. Within this set of requirements, reported compliance with cleaning protocols was far ahead of compliance with the other two standards (for environmental and personnel monitoring).
- Variation in compliance with requirements for standard operating procedures was noted in relation to hospital teaching status and across regions, with results aligned to those reported for compliance with physical space requirements (i.e., highest rates of compliance for pediatric hospitals and in QC).

Table C-8. Non-Hazardous Sterile Compounding Services – Compliance with Standards, 2016/17

	All	Hospital Type			Region				
		Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Non-hazardous sterile compounding services are completed in a physical space that meets the following physical space requirements outlined in the USP 797 standards: (n=)	(155)	(39)	(109)	(7)	(28)	(30)	(41)	(41)	(15)
a segregated ISO class 7 clean room	105	23	76	6	14	19	25	41	6
	68%	**59%**	**70%**		**50%**	**63%**	**61%**	**100%**	**40%**
a segregated ISO class 8 ante-room	80	17	57	6	7	10	18	41	4
	52%	**44%**	**52%**		**25%**	**33%**	**44%**	**100%**	**27%**
an environment that maintains positive pressure	111	28	76	7	13	19	30	40	9
	72%	**72%**	**70%**		**46%**	**63%**	**73%**	**98%**	**60%**
biological safety cabinets or laminar airflow workstations (hoods) for all sterile compounding	148	37	104	7	27	26	40	41	14
	95%	**95%**	**95%**		**96%**	**87%**	**98%**	**100%**	**93%**
an environment with full HEPA filtration and at least 20 air exchanges per hour	101	25	70	6	12	13	27	41	8
	65%	**64%**	**64%**		**43%**	**43%**	**66%**	**100%**	**53%**
none of the above	3	0	3	0	1	1	1	0	0
	2%	**0%**	**2%**		**3%**	**3%**	**2%**	**0%**	**0%**
Base: Facilities with sterile compounding for non-hazardous medications by the pharmacy department									
Note: multiple mentions permissible									
Standard operating procedures for non-hazardous sterile compounding services meet the following USP 797 standards: (n=)	(152)	(39)	(106)	(7)	(28)	(30)	(38)	(41)	(15)
environmental monitoring, daily monitoring of temperature and room pressure, surface sampling every 6 months	78	17	54	7	4	10	21	37	6
	51%	**44%**	**51%**		**14%**	**33%**	**55%**	**90%**	**40%**
cleaning protocols (hood, counters, floors cleaned daily; storage shelves, walls, ceilings cleaned monthly)	129	31	91	7	18	27	32	41	11
	85%	**79%**	**86%**		**64%**	**90%**	**84%**	**100%**	**73%**
personnel testing, gloved fingertip sampling, surface sample contamination testing, airborne particle testing	66	20	40	6	1	19	14	27	5
	43%	**51%**	**38%**		**4%**	**63%**	**37%**	**66%**	**33%**
none of the above	20	6	14	0	10	3	4	0	3
	13%	**15%**	**13%**		**36%**	**10%**	**11%**	**0%**	**20%**

Base: Facilities with sterile compounding for non-hazardous medications by the pharmacy department
Note: multiple mentions permissible
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Compliance with Standards: Hazardous Compounding

- Similar to the results for sterile compounding of non-hazardous preparations, the use of a biological safety cabinet or laminar airflow hood for sterile compounding of hazardous medications was reported by 96% (164/170) of respondents, and only 51% (86/170) reported that their hazardous compounding infrastructure included a segregated ISO class 8 ante-room (Table C-9).

- Only 25% (43/170) of respondents indicated compliance with all of the requirements outlined in the USP 800 standards, and 60% (26/43) of those were in QC. Notably, 67% (26/39) of QC respondents met all these requirements.

- The regional variation in compliance with the USP 800 standards was striking. For example, a segregated ISO class 7 clean room was reported by 97% (38/39) of QC respondents but only 48% (14/29) of BC/YT respondents. Regional differences were even greater for a segregated ISO class 8 ante-room: 97% (38/39) in QC and 28% (8/29) in BC/YT.

Compliance with standards for compounding of hazardous and non-hazardous preparations was markedly higher in Quebec than in all other regions.

Table C-9. Hazardous Sterile Compounding Services – Compliance with Standards, 2016/17

	All	Hospital Type			Region				
		Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Infrastructure supports the provision of sterile compounding services for hazardous medications by the pharmacy department (n=)	(170)	(40)	(123)	(7)	(29)	(34)	(48)	(39)	(20)
a segregated ISO Class 7 clean room	109	23	80	6	14	21	28	38	8
	64%	**58%**	**65%**		**48%**	**62%**	**58%**	**97%**	**40%**
a segregated ISO Class 8 ante-room	86	16	64	6	8	12	21	38	7
	51%	**40%**	**52%**		**28%**	**35%**	**44%**	**97%**	**35%**
an environment that maintains negative pressure	129	28	94	7	18	25	33	37	16
	76%	**70%**	**76%**		**62%**	**74%**	**69%**	**95%**	**80%**
biological safety cabinets or laminar airflow workstations (hoods) for all compounding	164	40	117	7	27	32	47	38	20
	96%	**100%**	**95%**		**93%**	**94%**	**98%**	**97%**	**100%**
an environment with full HEPA filtration	107	23	77	7	14	18	28	37	10
	63%	**58%**	**63%**		**48%**	**53%**	**58%**	**95%**	**50%**
meets all requirements outlined in the USP 800 standards	43	6	34	3	2	4	9	26	2
	25%	**15%**	**28%**		**7%**	**12%**	**19%**	**67%**	**10%**
none of the above	3	0	3	0	1	1	1	0	0
	2%	**0%**	**2%**		**3%**	**3%**	**2%**	**0%**	**0%**
Base: Facilities with sterile compounding for hazardous medications by the pharmacy department									
Note: multiple mentions permissible									
Storage of hazardous medications occurs in a negative pressure room with at least 12 air exchanges per hour *(n=)*	*(168)*	*(39)*	*(122)*	*(7)*	*(29)*	*(34)*	*(47)*	*(38)*	*(20)*
	80	17	57	6	8	6	21	34	11
	48%	**44%**	**47%**		**28%**	**18%**	**45%**	**89%**	**55%**

Base: Facilities with sterile compounding for hazardous medications by the pharmacy department
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Compliance with Standards: Beyond-Use Dating and Storage

The USP 797 and USP 800 standards[12,13] that underpin the new Canadian (NAPRA) standards provide a restrictive framework for beyond-use dating of compounded products according to the environment where each product is prepared, the risk of contamination and post-production storage conditions.

- Compliance with beyond-use dating standards was below 50% for sterile compounding of both non-hazardous medications (43%, 66/154) and hazardous medications (48%, 81/169) (Table C-10).

- Even in QC, where respondents reported high compliance with both infrastructure and policy standards, compliance with beyond-use dating standards was lower: 80% (32/40) for non-hazardous medications and only 58% (22/38) for hazardous medications.

Table C-10. Beyond Use Dating in Compliance with Standards, 2016/17

		All	Hospital Type			Region				
			Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Beyond-use dating for sterile compounded non-hazardous products adheres to USP 797 standards	(n=)	(154)	(39)	(108)	(7)	(28)	(30)	(41)	(40)	(15)
		66	17	47	2	11	5	11	32	7
		43%	**44%**	**44%**		**39%**	**17%**	**27%**	**80%**	**47%**
Base: Facilities with sterile compounding for non-hazardous medications by the pharmacy department										
Beyond-use dating for sterile compounded hazardous products adheres to USP 797 standards	(n=)	(169)	(40)	(122)	(7)	(29)	(34)	(48)	(38)	(20)
		81	16	63	2	17	16	12	22	14
		48%	**40%**	**52%**		**59%**	**47%**	**25%**	**58%**	**70%**

Base: Facilities with sterile compounding for hazardous medications by the pharmacy department
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Storage of hazardous medications in a negative pressure room with at least 12 air exchanges per hour is another requirement of the NAPRA and QC standards.[9,11]

- Overall, 48% (80/168) of respondents reported that hazardous drugs were stored in this manner (Table C-9). Compliance was most common in QC (89%, 34/38) and in pediatric hospitals (6/7).

The responses to these survey questions indicate that, despite the release of the NAPRA standards, with their clear requirements for both infrastructure and policy related to sterile compounding, much improvement is still needed in most regions of the country.

Drug Costs and Inventory Management

Drug Costs

- The average reported drug cost per acute care patient day (n = 134 respondents) was $44.58 (Table C-11), a notable 25% increase over 2011/12 ($35.73) (this information was not collected in the 2013/14 survey). A great deal of regional variation was seen, it is possible that there were regional variations in terms of which drug costs were reported.

Relative to 2011/12, drug costs per acute care patient day rose by 25% and drug costs per non-acute care patient day rose by 51%.

- The average reported drug cost per non-acute care patient day (n = 65 respondents) was $13.23, 51% higher than the $8.73 reported for 2011/12.

Inventory Turnover Rate

Table C-11. Inventory Turnover and Drug Costs, 2016/17

Inventory Turnover		All	Hospital Type			Region				
			Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Inventory turnover rate in the 2016/17 fiscal year	(n=)	(165)	(36)	(122)	(7)	(28)	(35)	(48)	(39)	(15)
		9.7	**10.6**	**9.5**	**9.6**	**9.3**	**6.5**	**11.4**	**11.2**	**8.9**
Base: All respondents providing inventory turnover data										
Drug cost ratios										
Acute drug costs per acute patient day	(n=)	(134)	(35)	(93)	(6)	(13)	(33)	(46)	(26)	(16)
		$44.58	**$51.05**	**$40.07**	**$76.70**	**$52.78**	**$31.19**	**$48.76**	**$52.81**	**$40.09**
Non-acute drug costs per non-acute patient day	(n=)	(65)	(12)	(51)	(2)	(1)	(8)	(28)	(17)	(11)
		$13.23	**$7.02**	**$15.01**	**$4.99**	**$4.57**	**$4.51**	**$19.13**	**$9.36**	**$11.28**

Base: All respondents providing drug cost data

- The average reported inventory turnover rate for 2016/17 was 9.7 times (Table C-11), essentially unchanged from both 2013/14 and 2011/12. Regional differences were noted, with higher inventory turnover rates reported by respondents from ON (11.4) and QC (11.2), and lower rates reported by respondents from BC/YT (9.3), the Atlantic provinces (8.9) and the Prairies (6.5). These regional rates are similar to data reported in 2013/14.

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D - Human Resources

André Bonnici

The relationship between staffing levels in hospital pharmacies and patient safety and health outcomes has been well documented.[1,2,3,4] However, attaining and maintaining the desired levels of pharmacy staffing in North American hospitals, especially Canadian hospitals, has been a challenge in past decades, mainly because of shortages of qualified personnel and financial constraints in healthcare organizations. Furthermore, with many novel medication therapies arriving on the marketplace and the ever-increasing complexity of pharmacotherapy regimens for the aging patient population in hospitals, the demand for pharmaceutical expertise has also been on the rise.

The American Society of Health-System Pharmacists (ASHP)[5] has taken the following positions on appropriate staffing levels:

- To advocate that pharmacists at each practice site base the site's pharmacist and technician staffing levels on patient safety considerations, taking into account factors such as (1) acuity of care, (2) breadth of services, (3) historical safety data, and (4) results of research on the relationship between staffing patterns and patient safety; further,
- To advocate that regulatory bodies not mandate specific, uniform pharmacy personnel ratios but rather ensure that site-specific staffing levels optimize patient safety; further,
- To encourage additional research on the relationship between pharmacy staffing patterns and patient safety.

In recent years, shortages of hospital pharmacists appear to be resolving in both the United States and Canada, according to surveys about vacant positions.[6] However, these data should be interpreted with care, keeping in mind that hospitals may not post vacant positions or may not have funding for additional needed positions. Hence, a low vacancy rate does not necessarily mean that the number of institutional pharmacists is adequate to provide safe and effective pharmaceutical care and services.

In the 2013/14 report, the reported vacancy rates for pharmacist positions appeared to indicate that staffing shortages in Canadian hospital pharmacies were finally under control. The overall increase in the availability of pharmacists in Canada combined with the adoption of legislation to regulate pharmacy technicians in most provinces would seem to support an increase in the proportion of time that pharmacists spend on clinical activities relative to drug distribution activities. Pharmacy technician vacancies were also relatively low in 2013/14, despite fears that regulation might create a temporary shortage. We therefore hoped that the 2016/17 survey would show a continuation of these trends.

Data from the Canadian Institute for Health Information (CIHI) indicate that the number of pharmacists in hospital pharmacy positions did indeed continue to increase in most provinces in 2016, although at a slower rate than in previous years.[7] According to CIHI, the number of new graduates from pharmacy programs in Canadian universities also continued to rise in 2016. The number of regulated pharmacy technicians in Canada in 2016 was estimated at 6,601.[8] In the United States, the ASHP has reported that vacancy rates for both pharmacists and technicians stabilized and remained low between 2010 and 2016.[6]

Human Resource Shortages – Pharmacists

Care is needed in interpreting vacancy rates, as they represent only existing positions that are currently vacant. They do not take into account positions that are occupied but for which the incumbent pharmacists are on leave (maternity leave or other types of leave) and have not been replaced. Furthermore, low vacancy rates do not necessarily indicate that all patient needs for pharmaceutical care are being met; they may simply reflect insufficient funding to create needed pharmacist positions.

- As of March 31, 2017, the average reported vacancy rate for hospital pharmacists (staff pharmacists and advanced practice pharmacists) was 4.8% (Table D-1). This is slightly lower than the vacancy rate reported for 2013/14 (5.1%) and markedly lower than rates reported for 2011/12 (8.1%) and 2009/10 (8.2%). However, Canada's current vacancy rate is higher than the 2.8% rate reported for the United States in a 2016 survey.[6]

- The reported number of pharmacist vacancies was higher in 2016/17 than in 2013/14 (171.5 vs. 154). The average number of vacant pharmacist positions per hospital/facility was slightly lower in 2016/17, at 0.96 (171 vacancies reported by 179 respondents), than in previous years: 0.99 in 2013/14 (154 vacancies reported by 156 respondents), 1.5 in 2011/12 (237 vacancies reported by 160 respondents) and 1.5 in 2009/10 (235 vacancies reported by 159 respondents).

- For 2016/17, pediatric hospitals had a higher pharmacist vacancy rate than did teaching hospitals and non-teaching hospitals (9.6% vs. 5.0% and 4.4%, respectively).

- On a regional basis, British Columbia/Yukon (BC/YT) had the highest pharmacist vacancy rate (10.9%), followed by Saskatchewan (SK; 7.3%) and Quebec (QC; 6.1%). For BC/YT and SK, these data represent increases relative to 2013/14, when pharmacist vacancies were 6.8% and 3.5%, respectively. For QC, the current data represent a slight improvement over 2013/14, when the rate was 7.4%. The increase in pharmacist vacancies in BC may be attributable, in part, to the increasing cost of living in that province in recent years, a period when hospital pharmacists' salaries have remained lower than the Canadian average. Also, certain pharmacist positions in BC are restricted to those who have completed a post-graduate year 1 (PGY1) pharmacy residency, according to the terms of the provincial labour contract.

The average vacancy rate for pharmacists in Canada has remained relatively low and stable; however, some regions, including BC/YT and SK, have seen their vacancy rates rise.

- Overall, 35% (55/155) of respondents reported vacant staff pharmacist positions, whereas 30% (28/93) reported vacant advanced practice pharmacist positions.

Human Resource Shortages – Pharmacy Technicians

In previous Hospital Pharmacy in Canada Reports, we postulated that the regulation of pharmacy technicians might create a temporary reduction in the availability of this type of personnel if a substantial number of pharmacy assistants failed to qualify for licensure. However, despite a rise in the number of vacant pharmacy technician positions, there has been no increase in the vacancy rate. We nonetheless urge caution in drawing any conclusions from the current data: it is possible that the transition from non-regulated to regulated pharmacy technician positions has been accomplished in many hospitals by displacement or attrition. Note: Where the term "pharmacy technician" is used below, it refers to both regulated and non-regulated pharmacy technicians, unless specified otherwise.

- In 2016/17, the vacancy rate for pharmacy technicians was 3.1%, lower than the 3.5% reported for 2013/14 and slightly higher than the 2.3% reported for 2011/12 and the 1.5% reported for 2009/10. (Notably, before 2013/14, vacancies for pharmacy assistants were combined with vacancies for pharmacy technicians, which had the result of lower calculated combined vacancy rates.) The current Canadian vacancy rate is also lower than the 4.9% reported for the United States in 2016.[6]

- The reported number of vacancies for pharmacy technicians (regulated and non-regulated) was higher in 2016/17 than in 2013/14 (142.6 vs. 105). The average number of vacant positions per hospital/facility was also higher in 2016/17 than in 2013/14 (0.82, 142.6 vacancies reported by 173 facilities, vs. 0.74, 105 vacancies in 141 facilities).

- Pediatric hospitals had a higher vacancy rate for pharmacy technicians in 2016/17 than did teaching and non-teaching hospitals (5.6%, 10/178, vs. 3.6%, 68.2/1870, and 2.5%, 64.4/2567, respectively).

There was no evidence of pharmacy technician or pharmacy assistant shortages, except in BC/YT and in pediatric hospitals.

- On a regional basis, the vacancy rate for pharmacy technicians was highest in BC/YT, at 5.9% (37.6/636), a notable increase over 2013/14 (1%). Like the increasing vacancy rate for pharmacists in that province, the rising vacancy rate for technicians may be due in part to the increasing cost of living in BC.

- The percentage of respondents reporting vacant positions for regulated pharmacy technicians was 39% (44/113), similar to the reporting of vacant positions for pharmacists.

Table D-1. Positions Vacant as of March 31, 2017

	All	Bed Size			Hospital Type			Province							
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	AB	SK	MB	ON	QC	NB/PE	NS/NL
Pharmacists (Staff + Advanced) (n=)	(175)	(48)	(77)	(50)	(39)	(130)	(6)	(29)	(16)	(6)	(13)	(49)	(42)	(8)	(12)
total number or positions	3,538	296	1,406	1,836	1,537	1,850	151	514	366	125	209	1,100	862	125	237
vacant positions	171.5	4.1	67.0	100.4	76.3	80.7	14.5	56.3	4.4	9.1	7.2	27.8	52.3	5.0	9.4
vacancy rate	**4.8%**	**1.4%**	**4.8%**	**5.5%**	**5.0%**	**4.4%**	**9.6%**	**10.9%**	**1.2%**	**7.3%**	**3.4%**	**2.5%**	**6.1%**	**4.0%**	**4.0%**
Pharmacist Managers (n=)	(162)	(42)	(73)	(47)	(39)	(117)	(6)	(29)	(16)	(5)	(12)	(43)	(40)	(8)	(9)
total number or positions	319	37	116	166	135	176	8	78	18	12	16	77	91	14	13
vacant positions	6.6	1.0	4.6	1.0	2.0	4.6	0.0	0.6	1.0	0.0	0.0	4.0	0.0	1.0	0.0
vacancy rate	**2.1%**	**2.7%**	**4.0%**	**0.6%**	**1.5%**	**2.6%**	**0.0%**	**0.8%**	**5.6%**	**0.0%**	**0.0%**	**5.2%**	**0.0%**	**7.4%**	**0.0%**
Pharmacy Technician Managers (n=)	(76)	(18)	(33)	(25)	(23)	(50)	(3)	(19)	(15)	(1)	(7)	(18)	(5)	(8)	(3)
total number or positions	100	16	45	39	41	56	3	24	19	3	10	23	8	11	2
vacant positions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
vacancy rate	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Regulated Pharmacy Technician (n=)	(113)	(33)	(52)	(28)	(24)	(86)	(3)	(28)	(16)	(3	(2)	(48)	(9)	(2)	(5)
total number or positions	2,536	264	1,040	1,232	914	1,549	73	532	305	55	3	1,358	171	8	104
vacant positions	79.1	5.0	35.9	38.2	24.1	49.0	6.0	31.6	3.6	4.0	0.0	39.4	0.5	0.0	0.0
vacancy rate	**3.1%**	**1.9%**	**3.5%**	**3.1%**	**2.6%**	**3.2%**	**8.2%**	**5.9%**	**1.2%**	**7.3%**	**0.0%**	**2.9%**	**0.3%**	**0.0%**	**0.0%**
Non-regulated Pharmacy Technicians/ Pharmacy Assistants (n=)	(112)	(30)	(45)	(37)	(30)	(77)	(5)	(16)	(16)	(6)	(12)	(10)	(33)	(8)	(11)
total number or positions	2,078	204	615	1,260	957	1,017	104	103	209	87	196	43	1,087	155	198
vacant positions	63.5	6.3	15.9	41.3	44.1	15.4	4.0	6.0	9.4	2.0	9.1	0.5	33.5	1.0	2.0
vacancy rate	**3.1%**	**3.1%**	**2.6%**	**3.3%**	**4.6%**	**1.5%**	**3.8%**	**5.8%**	**4.5%**	**2.3%**	**4.6%**	**1.2%**	**3.1%**	**0.6%**	**1.0%**
Regulated Pharmacy Technicians and Non-regulated Pharmacy Technicians/ Pharmacy Assistants (n=)	(173)	(48)	(75)	(50)	(38)	(129)	(6)	(28)	(16)	(6)	(13)	(49)	(41)	(8)	(12)
total number or positions	4,615	468	1,656	2,491	1,870	2,567	178	636	514	142	199	1,401	1,258	163	302
vacant positions	142.6	11.3	51.8	79.5	68.2	64.4	10.0	37.6	13.0	6.0	9.1	39.9	34.0	1.0	2.0
vacancy rate	**3.1%**	**2.4%**	**3.1%**	**3.2%**	**3.6%**	**2.5%**	**5.6%**	**5.9%**	**2.5%**	**4.2%**	**4.6%**	**2.8%**	**2.7%**	**0.6%**	**0.7%**

Base: All respondents with FTEs > 0 for the corresponding job categories

Human Resource Shortages – Managers

- The total number of vacant pharmacist management positions in 2016/17 was very low, with only 6.6 vacancies. The vacancy rate of 2.1% was similar to the rate of 1.7% reported for 2013/14.
- The vacancy rate for pharmacy technician managers was first reported for 2009/10, when there were no vacancies of this type. Similarly, there were no vacancies in 2016/17. These zero vacancy rates may reflect the small number of pharmacy technician manager positions in existence.

Pharmacy Staffing Ratios

This section of the report will be most useful for pharmacy directors and managers who want to compare their staffing allocations with those of other similar hospitals or to justify staffing requirements for new services to hospital administrators. In this report, average ratios are provided for all hospitals combined, for teaching versus non-teaching hospitals, for hospitals of different sizes and for hospitals within each region. The numerator in the ratio is the number of hours of staff time that a pharmacy department has at its disposal to provide pharmacy services (budgeted hours), and the denominator is the total number of patient days. Patient days is a measure that is widely used to assess and compare workload and resource allocation not only for pharmacy departments, but also for most other departments in the healthcare system, making it a proxy for workload that is universally accepted by healthcare executives. The number of patient days is admittedly an imperfect proxy for workload in the context of hospital pharmacy, but experience has shown that results expressed in these terms have a high degree of consistency and reproducibility, even when all types of patient days are grouped in the denominator. The 2016/17 survey included a benchmarking section that attempted to create staffing ratios for different types of patient days, such as critical care patient days, oncology patient days and medicine patient days. Those program-specific staffing ratios can be found in Chapter E, Benchmarking. Here, we report only pharmacy staffing ratios calculated for the hospital as a whole. Four distinct ratios have been calculated, to account for the composition of different hospitals in terms of acute care and non-acute care beds, and to account for the important investment of resources in ambulatory /outpatient programs that are provided in hospitals.

Total budgeted hours/acute patient day: This ratio excludes from the denominator patient days for non-acute care beds, such as long-term care beds, but it includes in the numerator budgeted hours allotted for non-acute care beds and for ambulatory care services.

Inpatient budgeted hours/acute patient day: This ratio affords a more accurate view of resources used specifically for inpatient-related acute care beds by excluding from the numerator budgeted hours allotted for ambulatory care and non-acute care, as well as excluding from the denominator patient days for non-acute care beds.

Total budgeted hours/total (acute + non-acute) patient day: This ratio is all-inclusive and should be used with caution by pharmacy managers, as there are important variations when the proportion of acute care beds is taken into account. For example, in 2013/14, in hospitals with 100% acute care beds, this ratio was 0.89, whereas in hospitals with 10%–39% acute care beds, the ratio was 0.32.

The most appropriate staffing ratio for assessment of inpatient resources is inpatient budgeted hours/acute inpatient day.

Inpatient budgeted hours/total (acute + non-acute) patient day: This ratio excludes from the numerator the hours devoted to providing ambulatory care services. However, as for the previous ratio, caution should be used, as important variations exist when the proportion of acute care beds is taken into account.

Two of these ratios use total budgeted hours because many respondents were unable to separate non-acute care workload (in hours) from acute care workload.

- As can be seen in Table D-2, excluding outpatient staffing from the numerator reduced the average staffing for all hospitals from 0.99 total budgeted hours/acute patient day to 0.89 inpatient budgeted hours/acute patient day. Likewise, excluding outpatient staffing from the numerator reduced the average staffing for all hospitals from 0.77 total budgeted hours/total patient day to 0.70 inpatient budgeted hours/total patient day. These data suggest that, on average, about 11% of all pharmacy staffing is dedicated to the provision of outpatient services. The larger the amount of outpatient staffing that a facility has, the greater the difference between ratios that include outpatient staffing in the numerator and those that do not.

Table D-2. Staffing Ratios – Budgeted Hours/Patient Day, 2016/17

		All	Bed Size			Hospital Type			Province							
			50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	AB	SK	MB	ON	QC	NB/PE	NS/NL
Inpatient budgeted hours per acute patient day	(n=)	(166)	(46)	(75)	(45)	(38)	(122)	(6)	(29)	(16)	(7)	(13)	(50)	(32)	(8)	(11)
		0.89	**0.88**	**0.90**	**0.89**	**0.94**	**0.83**	**1.82**	**0.86**	**0.99**	**0.73**	**0.69**	**0.95**	**0.86**	**0.91**	**0.92**
Inpatient budgeted hours per acute + non-acute patient day	(n=)	(161)	(44)	(72)	(45)	(37)	(118)	(6)	(27)	(16)	(7)	(12)	(50)	(31)	(7)	(11)
		0.70	**0.78**	**0.69**	**0.61**	**0.86**	**0.59**	**1.76**	**0.68**	**0.93**	**0.64**	**0.60**	**0.77**	**0.50**	**0.67**	**0.76**
Total budgeted hours per acute patient day	(n=)	(166)	(46)	(75)	(45)	(38)	(122)	(6)	(29)	(16)	(7)	(13)	(50)	(32)	(8)	(11)
		0.99	**0.93**	**0.99**	**1.03**	**1.06**	**0.92**	**1.90**	**0.89**	**1.05**	**0.76**	**0.76**	**1.05**	**1.06**	**1.02**	**0.99**
Total budgeted hours per acute + non-acute patient day	(n=)	(161)	(44)	(72)	(45)	(37)	(118)	(6)	(27)	(16)	(7)	(12)	(50)	(31)	(7)	(11)
		0.77	**0.83**	**0.77**	**0.71**	**0.97**	**0.65**	**1.83**	**0.70**	**0.98**	**0.67**	**0.67**	**0.85**	**0.62**	**0.77**	**0.82**

Base: All respondents providing staffing and patient days information

- Pediatric hospitals had, by far, the highest staffing ratios in all 4 ratio categories.
- Teaching hospitals continued to report higher total budgeted hours/acute care patient day than non-teaching hospitals (1.06 vs. 0.92).

Pediatric hospitals had, by far, the highest staffing ratios in all 4 ratio categories.

- The largest hospitals (those with > 500 beds) continued to report slightly higher total budgeted hours/acute care patient day than hospitals with 201–500 beds and hospitals with 50–200 beds (1.03 vs. 0.99 and 0.93, respectively).
- Teaching hospitals also reported higher inpatient budgeted hours/acute care patient day than non-teaching hospitals (0.94 vs. 0.83). However, this ratio was fairly constant, at 0.88 to 0.90, across all hospital sizes.
- On a regional basis, hospitals in Alberta (AB) and Ontario (ON) reported the highest staffing ratios in terms of inpatient budgeted hours/acute care patient days (0.99 and 0.95, respectively).

- Hospitals in QC had the lowest staffing ratios when total patient days was used as the denominator. This finding would imply that QC hospitals have a high number of non-acute patient days, and indeed, Chapter A, Demographics, shows that QC had a disproportionate number of non-acute care beds relative to its acute care beds (17,889 vs. 14,188).

- Overall, most staffing ratios have increased since 2007/08, indicating steady growth in pharmacy services in Canadian hospitals over the past decade (Table D-3).

Table D-3. Staffing Ratios – Trends from 2007/08 to 2016/17

Ratio		2016/17	2013/14	2011/12	2009/10	2007/08
Inpatient budgeted hours per acute inpatient day	(n=)	(166) **0.89**	(154) **0.89**	(155) **0.84**		
Inpatient budgeted hours per acute + non-acute inpatient day	(n=)	(161) **0.69**	(147) **0.65**	(150) **0.63**	(149) **0.62**	
Total budgeted hours per acute inpatient day	(n=)	(166) **0.99**	(154) **0.98**	(155) **0.91**	(154) **0.87**	(144) **0.85**
Total budgeted hours per acute + non-acute inpatient day	(n=)	(161) **0.77**	(147) **0.71**	(150) **0.68**	(149) **0.68**	(139) **0.63**

Base: All respondents providing staffing and patient days information
Note: Data are for total number of hospitals (including pediatrics)

Staff Composition of the Typical Hospital Pharmacy Department

To allow pharmacy directors to compare the staff composition of their respective departments with that of other comparable hospitals, this report includes data on the different types of staff that facilities employ, specifically, managers, staff pharmacists, pharmacy technicians, support staff and pharmacy residents. This information will be useful for examining characteristics such as pharmacy technician/pharmacist ratios and for comparing staff composition among different regions, between teaching and non-teaching hospitals, and among hospitals of different sizes.

- Respondents reported an average of 14.3 full-time equivalent (FTE) staff pharmacists and an average of 5.5 FTE advanced practice pharmacists (Table D-4). The only region with a higher ratio of advanced practice pharmacists to staff pharmacists was QC, as a result of the MSc advanced pharmacotherapy program that is offered at both pharmacy faculties in that province.

Table D-4. Average Budgeted Pharmacy Staffing (FTEs), 2016/17

	All	Bed Size			Hospital Type			Province							
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	AB	SK	MB	ON	QC	NB/PE	NS/NL
(n=)	(179)	(49)	(80)	(50)	(39)	(134)	(6)	(30)	(16)	(7)	(13)	(51)	(42)	(8)	(12)
Staff Pharmacists	**14.3**	**5.4**	**13.3**	**24.7**	**27.2**	**10.5**	**14.3**	**11.5**	**22.4**	**17.1**	**15.4**	**19.9**	**5.1**	**13.7**	**17.1**
Advanced Practice Pharmacists	**5.5**	**0.7**	**4.3**	**12.0**	**12.2**	**3.3**	**10.8**	**5.7**	**0.5**	**0.8**	**0.7**	**1.7**	**15.5**	**1.8**	**2.7**
Pharmacist Managers (who are pharmacists)	1.8	0.8	1.5	3.3	3.5	1.3	1.4	2.6	1.1	1.8	1.2	1.5	2.2	1.7	1.1
Pharmacy Managers (neither pharmacist or technician)	0.2	0.0	0.1	0.5	0.4	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0.5	0.3	0.5
Pharmacy Technician Managers (who are technicians)	0.6	0.3	0.6	0.8	1.0	0.4	0.5	0.8	1.2	0.4	0.8	0.5	0.2	1.4	0.2
Regulated Pharmacy Technicians	**14.2**	**5.4**	**13.0**	**24.6**	**23.4**	**11.6**	**12.2**	**17.7**	**19.1**	**7.9**	**0.2**	**26.6**	**4.1**	**1.0**	**8.6**
Non-regulated Pharmacy Technicians/ Pharmacy Assistants	**11.6**	**4.2**	**7.7**	**25.2**	**24.5**	**7.6**	**17.4**	**3.4**	**13.1**	**12.4**	**15.1**	**0.8**	**25.9**	**19.4**	**16.5**
Support Personnel (clerical /porter /aide)	1.3	0.2	1.1	2.6	3.0	0.8	1.5	0.8	1.3	0.6	0.6	1.3	1.9	1.5	1.0
Residents	0.7	0.1	0.8	1.4	2.2	0.3	0.9	1.0	0.1	1.0	0.2	0.6	1.3	0.5	0.3
Total pharmacy staff (including residents)	**50.1**	**17.0**	**42.3**	**95.1**	**97.5**	**35.9**	**59.1**	**43.6**	**58.6**	**41.9**	**34.2**	**53.0**	**56.5**	**41.2**	**48.0**
Subtotals:															
Pharmacists (Staff + Advanced)	**19.8**	**6.0**	**17.6**	**36.7**	**39.4**	**13.8**	**25.1**	**17.1**	**22.9**	**17.9**	**16.1**	**21.6**	**20.5**	**15.6**	**19.7**
Regulated Pharmacy Technicians and non-regulated Pharmacy Technicians/ Pharmacy Assistants	**25.8**	**9.5**	**20.7**	**49.8**	**48.0**	**19.2**	**29.6**	**21.2**	**32.1**	**20.3**	**15.3**	**27.5**	**29.9**	**20.4**	**25.2**

Base: All respondents providing staffing information

- Hospitals in AB, SK and Manitoba had the lowest average number of FTE advanced practice pharmacists.
- The average pharmacy technician/pharmacist ratio for all respondents was 1.45 (Table D-5). When only inpatient staff were included, the ratio was 1.54. The ratio for inpatient staff only was higher for non-teaching hospitals than for teaching hospitals and pediatric hospitals (1.61 vs. 1.35 and 1.34, respectively). The lower ratios for teaching and pediatric hospitals may be due to higher numbers of clinical pharmacists and teaching/research pharmacists in these institutions, which would increase the total number of pharmacists.

Table D-5. Ratio of Regulated Pharmacy Technicians + Non-regulated Pharmacy Technicians/ Assistants to Pharmacists, 2016/17

	All	Bed Size			Hospital Type			Province							
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	AB	SK	MB	ON	QC	NB/PE	NS/NL
Inpatient Technicians/Assistants to Inpatient Pharmacists (Staff + Advanced) (n=)	(165)	(40)	(74)	(45)	(38)	(121)	(6)	(29)	(16)	(6)	(13)	(50)	(31)	*(8)*	*(12)*
	1.54	**1.67**	**1.43**	**1.59**	**1.35**	**1.61**	**1.34**	**1.47**	**1.64**	**1.41**	**1.19**	**1.56**	**1.62**	**1.56**	**1.72**
Outpatient Technicians/Assistants to Outpatient Pharmacists (Staff + Advanced) (n=)	(117)	(20)	(57)	(40)	(34)	(78)	(5)	(15)	(10)	(4)	(9)	(35)	(30)	(7)	(7)
	0.90	**1.67**	**0.77**	**0.71**	**0.66**	**1.04**	**0.49**	**0.19**	**0.76**	**0.12**	**0.43**	**1.44**	**1.08**	**0.60**	**0.52**
Inpatient + Outpatient Technicians/ Assistants to Inpatient + Outpatient Pharmacists (Staff + Advanced) (n=)	(165)	(46)	(74)	(45)	(38)	(121)	(6)	(29)	(16)	(6)	(13)	(50)	(31)	*8)*	*(12)*
	1.45	**1.65**	**1.33**	**1.42**	**1.23**	**1.52**	**1.30**	**1.39**	**1.49**	**1.28**	**1.12**	**1.50**	**1.48**	**1.39**	**1.63**

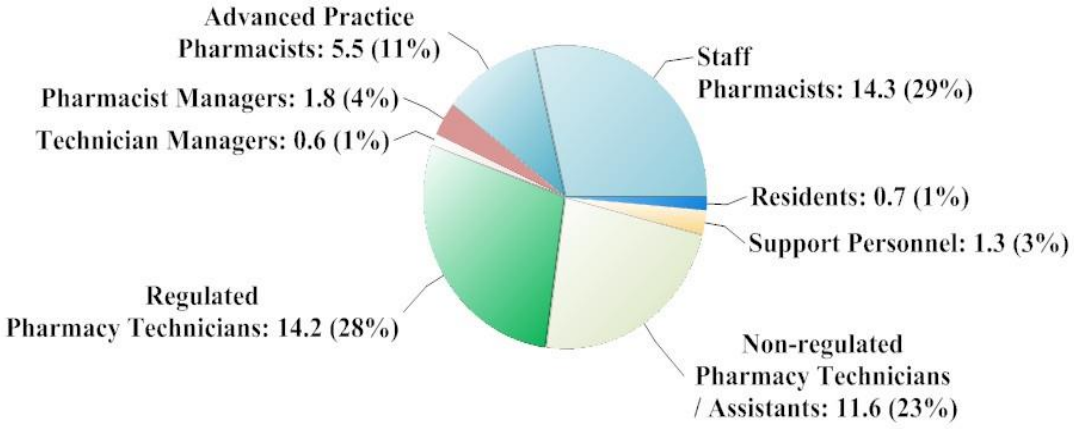
Base: All respondents providing staffing information

- Staff composition remained similar to that documented in previous reports. However, the proportion of advanced practice pharmacists has increased (from 9% in 2013/14 to 11% in 2016/17), as has the proportion of regulated pharmacy technicians (from 21% in 2013/14 to 28% in 2016/17) (Figure D-1).
- Together, staff pharmacists and advanced practice pharmacists represented 40% of the pharmacy workforce, similar to 39% in 2013/14.

The composition of the typical pharmacy department has been relatively stable over the past several surveys, with increases in the proportions of advanced practice pharmacists and regulated pharmacy technicians.

- Pharmacist management and technician management positions together represented 5% of staffing in 2016/17, similar to 4% in 2013/14.
- Pharmacy technician/assistant positions represented 51% of overall pharmacy staffing in 2016/17, similar to 52% in 2013/14 and 51% in both 2011/12 and 2009/10.
- Support personnel represented 3% of total pharmacy staffing in 2016/17, the same as in 2013/14.

Figure D-1. Staff Composition of the Typical Hospital Pharmacy Department, 2016/17



Base: All respondents who provided staffing data (179)

Overall, the percentage of time that pharmacists spend performing various functions has not changed substantially since the 2013/14 report, but the time spent on clinical activities continues to increase, with the time spent on drug distribution decreasing slightly, possibly indicating a plateau. Over time, it is evident that pharmacists' duties have shifted toward clinical activities (Table D-6).

Table D-6. Percentage of Pharmacist Time Spent Performing Different Activities – Trends from 2007/08 to 2016/17

Activity	2016/17	2013/14	2011/12	2009/10	2007/08
(n=)	(184)	(160)	(163)	(159)	(165)
Drug distribution	35%	36%	41%	40%	42%
Clinical activities	54%	51%	47%	47%	45%
Teaching	5%	6%	6%	6%	6%
Other non-patient care activities	5%	6%	5%	6%	6%
Pharmacy research	1%	1%	1%	1%	1%

Base: All respondents

Salaries

- The average salary for staff pharmacists in 2016/17 was similar regardless of hospital size or type (teaching, non-teaching or pediatric) (Table D-7a). However, there was a notable gap across regions, with AB having the highest average top-of-scale staff pharmacist salary ($122,238) and Nova Scotia/Newfoundland and Labrador the lowest ($90,464). The average top-of-scale salary for advanced practice pharmacists was highest in AB ($132,201), while the lowest is in New Brunswick/Prince Edward Island ($95,356).

Table D-7a. Average Annual Starting and Top Salaries by Position (Excluding Pharmacy Technicians), 2016/17

Position		All	Bed Size			Hospital Type			Province							
			50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	AB	SK	MB	ON	QC	NB/PE	NS/NL
Staff Pharmacist	(n=)	(162)	(47)	(69)	(46)	(34)	(123)	(5)	(30)	(18)	(7)	(13)	(50)	(24)	(8)	(12)
	Start $	85,272	86,461	83,905	86,107	87,581	84,500	88,544	77,759	107,051	91,215	85,950	81,323	89,142	86,559	75,038
	(n=)	(160)	(46)	(68)	(46)	(35)	(120)	(5)	(30)	(17)	(7)	(13)	(50)	(23)	(8)	(12)
	Top $	104,543	104,118	103,119	107,072	106,673	103,857	106,083	99,286	122,238	102,528	105,249	102,658	113,250	95,136	90,464
Advanced Practice Pharmacist	(n=)	(98)	(12)	(49)	(37)	(30)	(63)	(5)	(19)	(15)	(3)	(4)	(22)	(29)	(3)	(3)
	Start $	92,616	98,222	90,419	93,708	94,420	91,862	91,295	88,748	102,451	101,930	84,179	89,922	92,844	95,238	84,811
	(n=)	(99)	(13)	(49)	(37)	(32)	(62)	(5)	(18)	(15)	(3)	(5)	(21)	(31)	(3)	(3)
	Top $	116,269	124,735	113,728	116,660	116,401	116,114	117,353	110,469	132,201	118,197	109,555	107,256	121,785	95,356	107,681
Practice Leader/ Coordinator (Pharmacist)	(n=)	(69)	(11)	(36)	(22)	(24)	(41)	(4)	(22)	(16)	(1)	(2)	(15)	(9)	(3)	(1)
	Start $	104,188	114,482	100,762	104,647	103,669	103,049	118,974	103,353	121,684	92,373	94,453	87,875	112,481	88,636	90,637
	(n=)	(66)	(11)	(34)	(21)	(25)	(37)	(4)	(17)	(16)	(1)	(2)	(15)	(11)	(3)	(1)
	Top $	120,738	125,853	118,612	121,501	120,863	119,922	127,504	123,546	128,089	106,891	118,935	110,032	130,114	95,508	105,984
Pharmacy Supervisor/ Coordinator (Pharmacist)	(n=)	(44)	(5)	(20)	(19)	(17)	(24)	(3)	(17)	(0)	(1)	(1)	(5)	(15)	(3)	(2)
	Start $	92,509	89,556	95,481	90,158	96,795	88,602	99,478	87,998		95,559	117,218	88,390	102,016	74,472	83,022
	(n=)	(41)	(5)	(17)	(19)	(17)	(21)	(3)	(16)	(0)	(1)	(1)	(4)	(15)	(2)	(2)
	Top $	114,493	104,907	115,501	116,113	116,695	112,081	118,891	117,251		110,789	117,218	104,476	121,913	74,343	97,443
Pharmacist Manager	(n=)	(130)	(32)	(57)	(41)	(34)	(89)	(7)	(27)	(18)	(4)	(8)	(32)	(26)	(8)	(7)
	Start $	104,758	107,781	103,906	103,582	107,774	103,092	111,283	94,368	131,298	114,621	101,020	99,888	111,309	95,505	83,725
	(n=)	(134)	(34)	(56)	(44)	(37)	(90)	(7)	(27)	(17)	(5)	(10	(32)	(28)	(8)	(7)
	Top $	124,763	123,549	124,514	126,020	128,700	123,005	126,574	127,542	139,529	120,950	121,928	118,822	131,975	104,442	106,502
Pharmacy Manager neither a pharmacist or a technician)	(n=)	(19)	(1)	(11)	(7)	(8)	(11)	(0)	(0)	(0)	(0)	(0)	(7)	(9)	(3)	(0)
	Start $	74,868	84,000	79,324	66,561	68,964	79,162						87,563	68,488	64,383	
	(n=)	(18)	(1)	(9)	(8)	(8)	(10)	(0)	(0)	(0)	(0)	(0)	(6)	(9)	(2)	(1)
	Top $	90,476	101,000	93,451	85,813	87,727	92,674						103,547	84,591	76,232	93,500
Pharmacy Technician	(n=)	(70)	(15)	(32)	(23)	(20)	(47)	(3)	(18)	(18)	(0)	(3)	(17)	(3)	(8)	(3)
	Start $	64,548	67,912	61,969	65,941	65,900	63,454	72,659	56,512	82,941		41,173	69,312	52,214	46,614	58,935
Manager	(n=)	(59)	(16)	(23)	(20)	(20)	(36)	(3)	(9)	(17)	(1)	(3)	(16)	(3)	(7)	(3)
	Top $	82,327	82,943	77,442	87,452	84,934	79,511	98,744	56,861	114,802	85,000	53,886	84,975	65,436	50,621	79,005
Resident Stipend	(n=)	(65)	(10)	(28)	(27)	(31)	(29)	(5)	(19)	(13)	(2)	(1)	(13)	(14)	(2)	(1)
		41,687	44,563	41,535	40,780	40,179	42,739	44,941	43,895	50,852	45,658	34,000	35,027	38,480	32,500	30,206

Base: Respondents who provided salary information

- The average top-of-scale salary for regulated pharmacy technicians was highest in AB ($78,137) and lowest in QC ($43,492) (Table D-7b). The low salaries for regulated technicians in QC probably reflect the fact that QC is the only province without regulation of pharmacy technicians.
- Pharmacy technicians in pediatric hospitals were paid higher salaries than those in teaching and non-teaching hospitals.
- For all staffing categories, average starting salaries have increased over time (Table D-8).
- Pharmacy directors' salaries appear to have increased considerably since 2013/14, with 23% earning $160,000 or more in 2016/17, compared with only 9% in 2013/14 (Table D-9).

There is substantial variation among Canadian regions in terms of pharmacists' salaries.

Table D-7b. Average Annual Starting and Top Salaries of Regulated and Non-regulated Pharmacy Technicians/Assistants, 2016/17

Position		All	Bed Size			Hospital Type			Province							
			50 - 200	201- 500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	AB	SK	MB	ON	QC	NB/PE	NS/NL
Starting and top salaries of nonregulated pharmacy technician/pharmacy assistant																
Non-regulated Pharmacy Technician / Pharmacy Assistant	(n=)	(108)	(29)	(45)	(34)	(30)	(73)	(5)	(15)	(17	(7)	(10)	(13)	(28)	(9)	(9)
	Start $	41,066	44,054	40,050	39,863	41,179	41,084	40,131	45,048	40,098	50,620	38,794	46,435	35,761	40,323	40,847
	(n=)	(109)	(30)	(43)	(36)	(31)	(73)	(5)	(14)	(17)	(7)	(12)	(13)	(29)	(8)	(9)
	Top $	48,563	50,507	47,151	48,632	48,471	48,653	47,825	48,813	50,212	54,424	46,290	55,434	45,871	44,136	46,221
Starting and top salaries when there is only one level of regulated pharmacy technician																
Regulated Pharmacy Technician (one level only)	(n=)	(71)	(29)	(28)	(14)	(12)	(57)	(2)	(7)	(18)	(4)	(2)	(28)	(10)	(0)	(2)
	Start $	54,013	56,067	51,894	53,997	59,488	52,140	74,547	52,767	72,956	61,221	.	49,722	34,831		.
	(n=)	(71)	(30)	(27)	(14)	(12)	(57)	(2)	(8)	(18)	(4)	(2)	(27)	(10)	(0)	(2)
	Top $	60,306	60,460	59,299	61,917	67,897	58,070	78,473	52,718	78,137	65,596	.	57,987	43,492		.
Starting and top salaries when there are 2 levels of regulated pharmacy technician																
Regulated Pharmacy Technician - Level 1 / Staff (Level 2 exists)	(n=)	(49)	(6)	(27)	(16)	(15)	(32)	(2)	(19)	(0)	(2)	(0)	(22)	(1)	(2)	(3)
	Start $	50,247	45,570	50,359	51,812	52,011	49,547		52,313		.		50,804	.	.	38,605
	(n=)	(31)	(4)	(17)	(10)	(11)	(19)	(1)	2)	(0)	(2)	(0)	(22)	(1)	(1)	(3)
	Top $	55,890	49,151	55,542	59,177	57,713	54,923				.		58,270	.	.	43,732
Regulated Pharmacy Technician - Level 2 / Senior (Level 1 exists)	(n=)	(49)	(6)	(27)	(16)	(15)	(32)	(2)	(19)	(0)	(2)	(0	(22	(1)	(2)	(3)
	Start $	53,831	46,883	54,060	56,052	55,794	53,111		52,543		.		57,838	.	.	40,624
	(n=)	(30)	4)	(16)	(10)	(11)	(18)	(1)	(2)	(0)	(2)	(0)	(21)	(1)	(1)	(3)
	Top $	61,635	51,347	62,305	64,680	64,892	59,724				.		65,477	.	.	45,582

Base: Respondents who provided salary information
If no data is shown, it is because there were fewer than 3 responses

Table D-8. Average Starting Salaries – Trends from 2007/08 to 2016/17

Position		2016/17	2013/14	2011/12	2009/10	2007/08
Pharmacist Manager	(n=)	(130)	(127)	(115)	(110)	(122)
		104,758	96,318	89,718	90,843	87,290
Pharmacy Manager (neither pharmacist nor technician)	(n=)	(19)	(34)	(25)	(10)	(14)
		74,868	63,198	71,708	67,611	62,006
Practice Leader/Coordinator	(n=)	(69)	(66)	(60)	(55)	(62)
		104,188	90,843	82,282	84,897	83,600
Pharmacy Supervisor/Coordinator	(n=)	(44)	(53)	(49)	(39)	(43)
		92,509	87,515	83,076	81,247	80,416
Technician Manager	(n=)	(70)	(66)	(60)	(55)	(26)
		64,548	57,690	54,976	53,464	51,992
Staff Pharmacist	(n=)	(162)	(149)	(142)	(138)	(130)
		85,272	82,576	77,286	76,784	73,467
Advanced Practice Pharmacist (PharmD/ MSc)	(n=)	(98)	(76)	(77)	(46)	(70)
		92,616	87,681	84,696	81,099	74,502
Regulated Pharmacy Technician (where only one level exists)	(n=)	(71)	(51)			
		54,013	47,637			
Regulated Pharmacy Technician - Level 1 / Staff (where Level 2 exists)	(n=)	(49)	(32)			
		50,247	49,713			
Regulated Pharmacy Technician - Level 2 / Senior (where Level 1 exists)	(n=)	(49)	(32)			
		53,831	52,931			
Non-regulated Pharmacy Technician/Assistant	(n=)	(108)	(84)			
		41,066	40,375			

Base: All respondents
Note: Data are for total number of hospitals (including pediatrics)

Table D-9. Director Salary Ranges – Trends from 2007/08 to 2016/17

Salary Range	2016/17	2013/14	2011/12	2009/10	2007/08
(n=)	(175)	(165)	(172)	(155)	(162)
under $ 90,000	1%	1%	5%	6%	15%
$ 90,000 - $ 99,999	2%	5%	10%	10%	20%
$100,000 - $109,999	7%	10%	13%	19%	29%
$110,000 - $119,999	10%	13%	18%	22%	12%
$120,000 - $129,000	13%	28%	19%	19%	14%
$130,000 - $139,000 ($130,000 or more)	9%	19%	11%	25%	10%
$140,000 - $149,999 ($140,000 or more)	23%	8%	24%		
$150,000 - $159,999	12%	6%			
$160,000 - $169,999 ($160,000 or more)	6%	9%			
$170,000 or more	17%				

Base: All respondents
Note: Data are for total number of hospitals (including pediatrics)

Conclusion

Data from the 2016/17 survey indicate that vacancy rates for pharmacist positions in Canada are moderate to low. However, pharmacist vacancy rates remain high in pediatric hospitals, and there has been a substantial rise in vacancies in at least one region (BC/YT). The vacancy rates for pharmacy technician positions remain low in all regions. Overall, pharmacy staffing ratios have continued to increase, while the composition of the typical pharmacy department has remained essentially unchanged since 2013/14. However, there continues to be considerable variation among regions in terms of the proportion of advanced practice pharmacists on staff. The proportion of time that pharmacists spend on clinical activities continues to increase, with a concomitant decrease in time spent on drug distribution activities. In fact, pharmacists now spend the majority of their time performing clinical activities. Salaries for all categories of pharmacy staff have continued to increase, with regional differences for both pharmacists and pharmacy technicians.

It will be interesting to see if the importance of clinical activities performed by pharmacists will increase the demand for these healthcare professionals, leading to further increases in staffing ratios.

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E – Benchmarking/ Resource Matrix

Jean-François Bussières and Douglas Doucette

The importance of benchmarking as part of the Hospital Pharmacy in Canada Survey and Report has been recognized for at least two decades. Since 1985, the survey has collected quantitative data allowing comparisons among Canadian hospitals, in relation to hospital size, hospital type and geographic region. Previous reports have included a variety of simple ratios covering much of the data collected (e.g., number of budgeted hours per patient day).

In 1997/98, recognizing that some patient care programs require more human and material resources than others, we began soliciting more specific data for certain targeted programs, including oncology and critical care. This process has culminated in development of a matrix, in spreadsheet format for the reporting of data on human and material resources. This new matrix was included for the first time in the 2016/17 survey. Ultimately, widespread use of this matrix should ensure that all respondents present their human and material resources data in the same way, which will allow more robust comparisons in the future. However, the benchmarks generated by this new matrix differ in certain ways from those documented previously, and we therefore prefer not to make direct comparisons with benchmarks in past reports.

In addition to concerns about comparability with previous reports, we recommend that the benchmarking data reported here be interpreted with caution, because the number of respondents per cell was variable. Furthermore, most of the benchmarking data did not have a normal distribution. Thus, the data presented in this chapter are non-parametric, with median values being reported, and ranges being expressed as 10th and 90th percentiles (instead of minimum and maximum). Although respondents were asked to provide detailed data for 12 specified patient care programs, sufficient data for reporting were collected for only 10 of these programs.

- The median number of inpatient budgeted hours per inpatient day was higher for technician staff (0.32) than for pharmacists (0.26).

- Among inpatient pharmacists, the median number of hours per inpatient day was highest for adult critical care (0.48), followed by pediatrics within a general hospital (0.39), oncology (0.38) and pediatric and/or neonatal critical care (0.32). General medicine (0.18), general surgery (0.16), rehabilitation (0.11) and gynecology and/or obstetrics (0.10) tended to have lower values for this benchmark.

- The median number of inpatient beds per inpatient automated dispensing cabinet was 16.

- Human resources devoted to outpatient activities were more variable relative to most inpatient programs. Although pharmacy departments within healthcare facilities typically dedicate more resources to services for inpatients, it is equally important to collect (and then analyze trends for) comparative data for outpatient services.

- Outpatient staff pharmacist hours per 100 outpatient visits was higher for oncology (22.47) and general medicine (13.33). Other program types had far fewer assigned hours per 100 visits, or the number of respondents was too low (i.e. <7) to calculate meaningful 10th and 90th percentiles.

With the experience gained through using the 2016/17 data collection tool (the new matrix), we expect to improve data collection and simplify the gathering of information from respondents in the next survey.

Table E-1 shows some key ratios for inpatient and outpatient hospital pharmacy practice.

Table E-1. Key Ratios in Hospital Pharmacy Practice, 2016/17

Ratios		Patient care programs										
		TOTAL	Emergency	General Medicine	General Surgery	Oncology	Adult Critical Care	Gynecology Obstetrics	Mental Health	Rehab-ilitation	Pediatrics within a General Hospital	Pediatric and Neonatal Critical Care
Inpatient budgeted pharmacist hours per inpatient day	(n=)	(121)	(0)	(26)	(22)	(12)	(25)	(12)	(20)	(9)	(10)	(11)
	10. %ile	0.14		0.06	0.08	0.10	0.25	0.02	0.07	0.04	0.12	0.15
	Median	**0.26**		**0.18**	**0.16**	**0.38**	**0.48**	**0.10**	**0.14**	**0.11**	**0.39**	**0.32**
	90. %ile	0.51		0.34	0.35	0.72	1.06	0.55	0.24	0.32	1.71	0.64
Inpatient budgeted technician hours per inpatient day	(n=)	(120)	(0)	(12)	(12)	(< 7)	(10)	(8)	(7)	(< 7)	(< 7)	(< 7)
	10. %ile	0.16		0.04	0.02		0.12	0.03	0.03			
	Median	**0.32**		**0.16**	**0.11**		**0.54**	**0.15**	**0.13**			
	90. %ile	0.54		0.43	0.46		2.58	1.01	0.20			
Inpatient drug costs per inpatient day	(n=)	(123)	(0)	(26)	(25)	(10)	(22)	(20)	(19)	(17)	(16)	(11)
	10. %ile	$15.35		$13.41	$20.07	$37.58	$63.98	$13.60	$5.17	$4.91	$5.28	$10.98
	Median	**$29.37**		**$21.06**	**$27.05**	**$107.40**	**$92.79**	**$26.24**	**$8.68**	**$10.12**	**$17.49**	**$21.19**
	90. %ile	$96.93		$35.12	$51.45	$309.45	$147.98	$62.08	$14.34	$35.50	$37.97	$62.88
Number of inpatient beds per inpatient ADC	(n=)	(89)	(0)	(35)	(34)	(14)	(38)	(24)	(24)	(13)	(12)	(17)
	10. %ile	7.50		12.00	10.96	10.00	4.00	8.25	10.86	11.00	3.20	6.60
	Median	**16.00**		**21.00**	**20.92**	**19.50**	**9.39**	**12.00**	**20.00**	**18.00**	**9.50**	**13.80**
	90. %ile	140.00		49.00	40.00	30.00	14.00	21.00	35.00	75.00	17.00	33.00
Outpatient budgeted staff pharmacist hours per 100 outpatient visits	(n=)	(69)	(27)	(7)	(< 7)	(18)	(0)	(< 7)	(< 7)	(0)	(< 7)	(0)
	10. %ile	1.11	0.72	4.73		7.48						
	Median	**3.44**	**3.07**	**13.33**		**22.47**						
	90. %ile	16.56	7.03	16.79		90.28						
Outpatient drug costs per outpatient visit	(n=)	(62)	(43)	(< 7)	(< 7)	(17)	(0)	(< 7)	(< 7)	(0)	(< 7)	(0)
	10. %ile	$3.26	$4.01			$10.52						
	Median	**$14.77**	**$8.65**			**$239.82**						
	90. %ile	$69.95	$19.01			$467.02						

Base: Adult and Pediatric hospitals providing matrix data
Data not shown if n <7 as 10th and 90th percentiles would not be meaningful

F - Pharmacy Technicians

Douglas Doucette

As of the 2016/17 survey period, 9 of Canada's 10 provinces had legislation in place protecting the title Pharmacy Technician and designating pharmacy technicians as regulated health professionals. Ontario (ON) was the first to introduce legislation covering pharmacy technicians in 2010[1] followed by Alberta (AB)[2] and British Columbia (BC),[3] starting the transition to a regulated health profession in Canada. Nova Scotia (NS) proclaimed its new Pharmacy Act in 2013,[4] with relevant legislation being enacted in Manitoba (MB),[5] New Brunswick (NB),[6] Prince Edward Island (PE)[7] and Newfoundland and Labrador (NL)[8] in 2014 and in Saskatchewan (SK)[9] in 2015.

In Quebec (QC), regulations related to the Pharmacy Act define limited the activities that a pharmacy clerk is permitted to perform under a pharmacist's supervision, but these regulations do not specify requirements for education or competencies of a pharmacy clerk.[10] In 2014, the Ordre des pharmaciens du Québec adopted practice standards and competency profiles for pharmacy technical personnel and pharmacy support personnel.[11] It is anticipated that the QC Ministry of Education will evaluate these standards and enable the necessary regulatory change to allow the term "Pharmacy Technician" to be used in that province.

The Yukon (YT), Northwest Territories and Nunavut had no legislation in place before March 31, 2017, for the regulation of pharmacy technicians.

In 2008, the Canadian Council for Accreditation of Pharmacy Programs (CCAPP) introduced its accreditation process for schools that offer pharmacy technician programs. As of early 2018, 38 schools in Canada and 1 school in Qatar have been accredited by the CCAPP. [12] As of December 2017, two additional Canadian schools had received provisional accreditation status.[13]

The Pharmacy Examining Board of Canada (PEBC) is the national certification body for pharmacists and pharmacy technicians. All Canadian pharmacy technicians currently practising in the profession must pass the PEBC Pharmacy Technician Evaluating Examination by December 31, 2018, to be eligible to apply for the Qualifying Examination to become a regulated pharmacy technician. After this deadline, only Canadian graduates of a CCAPP-accredited program will be eligible to apply for the PEBC Qualifying Examination. The Evaluating Examination will be offered in three provinces in spring 2018 and four provinces in fall 2018. The Qualifying Examination will be offered in 8 cities across six provinces in spring 2018 and in 10 cities across eight provinces in fall 2018.[14] As of January 1, 2018, there were 8,185 regulated pharmacy technicians in Canada.[15]

The National Association of Pharmacy Regulatory Authorities assumed responsibility for delivering the National Pharmacy Technician Bridging Education Program in 2013.[16] The program was originally developed in Ontario in 2008 and adapted for use in Alberta and British Columbia in 2010. The program has been delivered by authorized educational institutions, in classroom settings or online, in English since 2013. Since January 2015, a French-language version of the National Pharmacy Technician Bridging Education Program has been available for online delivery by BC's Selkirk College.[17,18]

Much of the literature on the roles of pharmacy technicians has focused on medication distribution activities. Recent reports from Canada and elsewhere have examined the progressive roles of competent pharmacy technicians in direct patient care, such as obtaining best possible medication histories (BPMHs), tracking laboratory test results, and aiding in completion of comprehensive medication reviews.[19] Obtaining the BPMH was the most common role of pharmacy technicians in the emergency department (ED), occurring at 87% of sites that responded to a Canadian survey.[20] Furthermore, in the ED, dialysis clinic and pre-operative settings, pharmacy technicians were found to obtain BPMHs as effectively as pharmacists.[21,22,23] Expansion of the role of pharmacy technicians to incorporate obtaining BPMHs and providing other clinical support activities in ED and unit-based teams would enable pharmacists to provide more direct patient care services.[24]

Expanded roles for pharmacy technicians in oncology clinics have included gathering pre-determined clinical data, assembling patient education materials, documenting drug coverage, and providing patient medication calendars for chemotherapy protocols. Training pharmacy technicians to perform chemotherapy order entry as accurately and safely as pharmacists potentially allows time to be freed up for pharmacists to provide direct patient care.[25] For admitted patients, pharmacy technicians trained to support a pharmacy-managed warfarin dosing service provided treatment recommendations similar to those recommended by clinical pharmacists.[26]

A single-blind study conducted in an inpatient dispensary of a major Australian hospital showed that the overall accuracy of checking medication orders was greater when pharmacy technicians performed this task than when pharmacists did so. These results indicate that trained pharmacy technicians can verify medication orders safely and accurately, supporting the tech-check-tech model in the hospital environment.[27]

The benefits of an enhanced role for pharmacy technicians have also been recognized by national professional associations in countries other than Canada. For example, the American Society of Health-System Pharmacists recently released a position statement recognizing pharmacy technicians as the foundation of a pharmacy's distributive functions, acknowledging their roles in clinical functions and calling for the development of standardized education, training and competency assessment for pharmacy technicians in the United States.[28] The Society of Hospital Pharmacists of Australia released a white paper focused on expanding the scope of practice of pharmacy technicians and assistants to enable the development of future models of clinical practice.[29]

Advancing pharmacy practice calls for new and more advanced roles for pharmacists, pharmacy technicians and other pharmacy support personnel, all working to their full scope of practice. To improve pharmaceutical clinical services and patient outcomes, pharmacy technicians and other pharmacy support personnel should take over operational roles formerly performed only by pharmacists, allowing the latter group to shift their focus towards more collaborative team-based and patient-centred responsibilities.[30]

Technician Roles and Validation Requirements

Summarized in Table F-1 are functions performed by pharmacy technicians, indicating whether technicians check the work of other technicians who perform these functions and whether a validation program must be completed before the technician can perform or check each activity. Validation refers to an internal pharmacy process designed to ensure that a pharmacy technician is qualified to perform a particular task. Validation is based on a defined institutional policy and/or procedure that describes the training required to perform a task and establishes the objective assessment criteria used to confirm a pharmacy technician's ability to perform that specific task with a high degree of accuracy.

Table F-1. Functions Performed by Technicians, Functions Checked by Technicians and Validation Requirements, 2016/17

Function	A (n=)	B Function performed (n=A)	C Validation required to perform task (n=B)	D Checked by technician (n=B)	E Validation required to check (n=D)
Perform medication order entry	(184)	141 **77%**	73 **52%**	17 **12%**	10 **59%**
Fill traditional prescriptions: new orders	(184)	160 **87%**	73 **46%**	105 **66%**	77 **73%**
Fill traditional prescriptions: refills	(184)	158 **86%**	70 **44%**	115 **73%**	86 **75%**
Package unit dose items	(184)	172 **93%**	82 **48%**	151 **88%**	104 **69%**
Fill unit dose trays	(184)	150 **82%**	77 **51%**	126 **84%**	100 **79%**
Fill interim doses	(184)	156 **85%**	76 **49%**	121 **78%**	85 **70%**
Prepare patient-specific IV admixtures	(184)	175 **95%**	131 **75%**	109 **62%**	85 **78%**
Prepare batch IV admixtures	(184)	167 **91%**	123 **74%**	117 **70%**	91 **78%**
Prepare TPN solutions	(184)	156 **85%**	115 **74%**	71 **46%**	55 **77%**
Prepare chemotherapy	(184)	161 **88%**	119 **74%**	44 **27%**	41 **93%**
Prepare extemporaneous compounds	(184)	184 **100%**	87 **47%**	131 **71%**	82 **63%**
Fill cardiac arrest trays	(184)	151 **82%**	59 **39%**	116 **77%**	71 **61%**
Replenish automated dispensing cabinets	(184)	146 **79%**	67 **46%**	100 **68%**	61 **61%**

Base: All respondents
Base for 'Function performed': All respondents
Base for 'Functions Checked by Technician': Respondents reporting that technicians perform that activity (Column B)
Base for 'Validation required to perform task': Respondents reporting that technicians perform that activity (Column B)
Base for 'Validation required to check': Respondents reporting that technicians check that activity performed by technicians (Column D)

- With the exception of two activities, the rate of performance of specific functions by pharmacy technicians has remained largely unchanged since 2009/10.

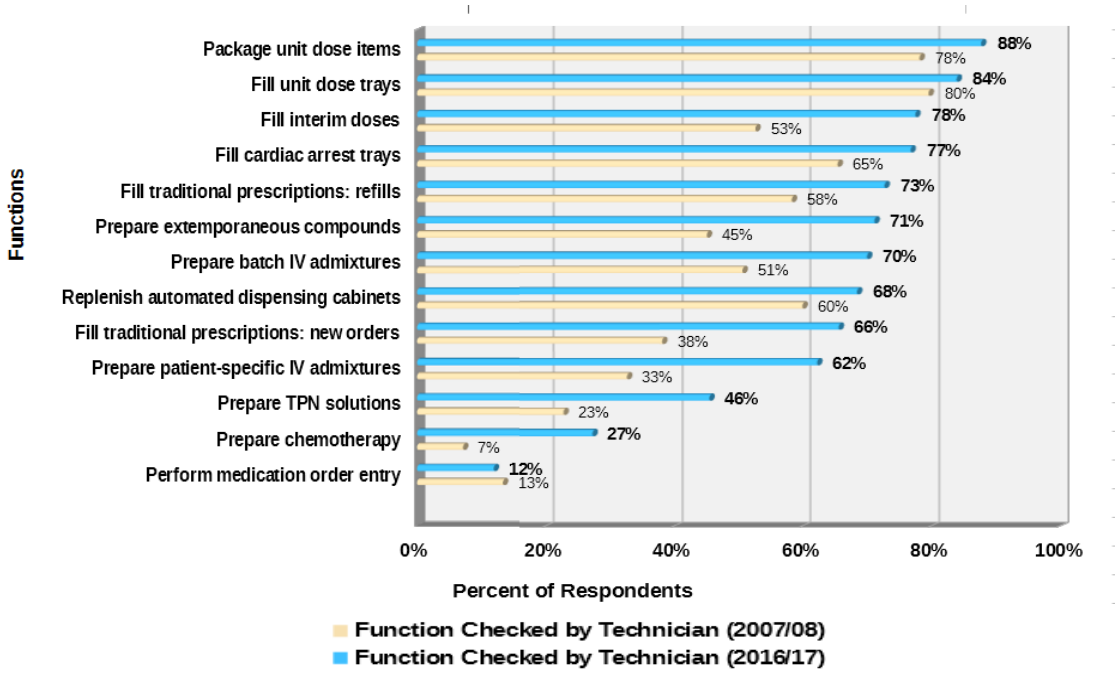
- One area of continued growth is replenishment by pharmacy technicians of automated dispensing cabinets, reported by 79% (146/184) of facilities in the current survey, up from 71% (114/160) in 2013/14 and 61% (93/152) in 2009/10. In 2016/17, this task was being performed by at least 50% of technicians in all regions, although rates were notably lower in the Prairie provinces (AB, SK, MB; 50%, 19/38) and BC (67%, 20/30) than in ON, QC and the Atlantic provinces (NB, NS, PE, NL), where rates exceeded 80%. Compared with 2013/14, there was less variation in 2016/17 in relation to hospital size, with the highest rate still observed for facilities with more than 500 beds (89%, 47/53; 93%, 42/45 in 2013/14) and somewhat lower rates for facilities with 50–200 beds (74%, 37/50; increased from 55% (23/42) in 2013/14).

- The filling of unit-dose trays by pharmacy technicians increased from 74% (115/155) in 2009/10 and 76% (121/159) in 2013/14 to 82% (150/184) in 2016/17. In the current survey, performance of this activity by pharmacy technicians was reported as more frequent in hospitals with more than 500 beds (87%, 46/53) than in hospitals having 201–500 beds (81%, 66/81) or 50–200 beds (76%, 38/50). There was little difference in frequency of unit-dose tray filling by pharmacy technicians in relation to hospital type: 81% (110/136) for teaching hospitals, 83% (34/41) for in non-teaching hospitals and 6 of 7 pediatric sites. However, there was some regional variation, with the lowest rates reported in BC (67%, 20/30) and the Prairies (68%, 26/38), somewhat higher rates in the Atlantic provinces (86%, 18/21) and ON (87%, 45/52), and the highest rate in QC (95%, 41/43).

The rates of performance of specific functions by pharmacy technicians have remained stable over the past decade, except for increases in rates of replenishing automated dispensing cabinets and filling unit-dose trays.

There does not appear to have been much change in the functions checked by pharmacy technicians since 2013/14. However, technicians' checking of the work of other technicians has increased substantially relative to 2007/08 (Figure F-1). Over the past four reports, there has been growth of 20 percentage points or more in the proportion of facilities reporting that technicians check the preparation of total parenteral nutrition (TPN), chemotherapy, batch and patient-specific IV admixtures, and the filling of new medication orders. For example, since 2007/08, the percentage of facilities reporting that technicians check the work of other technicians has increased from 7% to 27% for the preparation of chemotherapy and from 23% to 46% for the preparation of TPN solutions. These increases have probably occurred because regulated pharmacy technicians are now allowed to perform such checks, instead of pharmacists being required to do so.

Figure F-1. Functions Checked by Pharmacy Technicians, 2007/08 vs. 2016/17

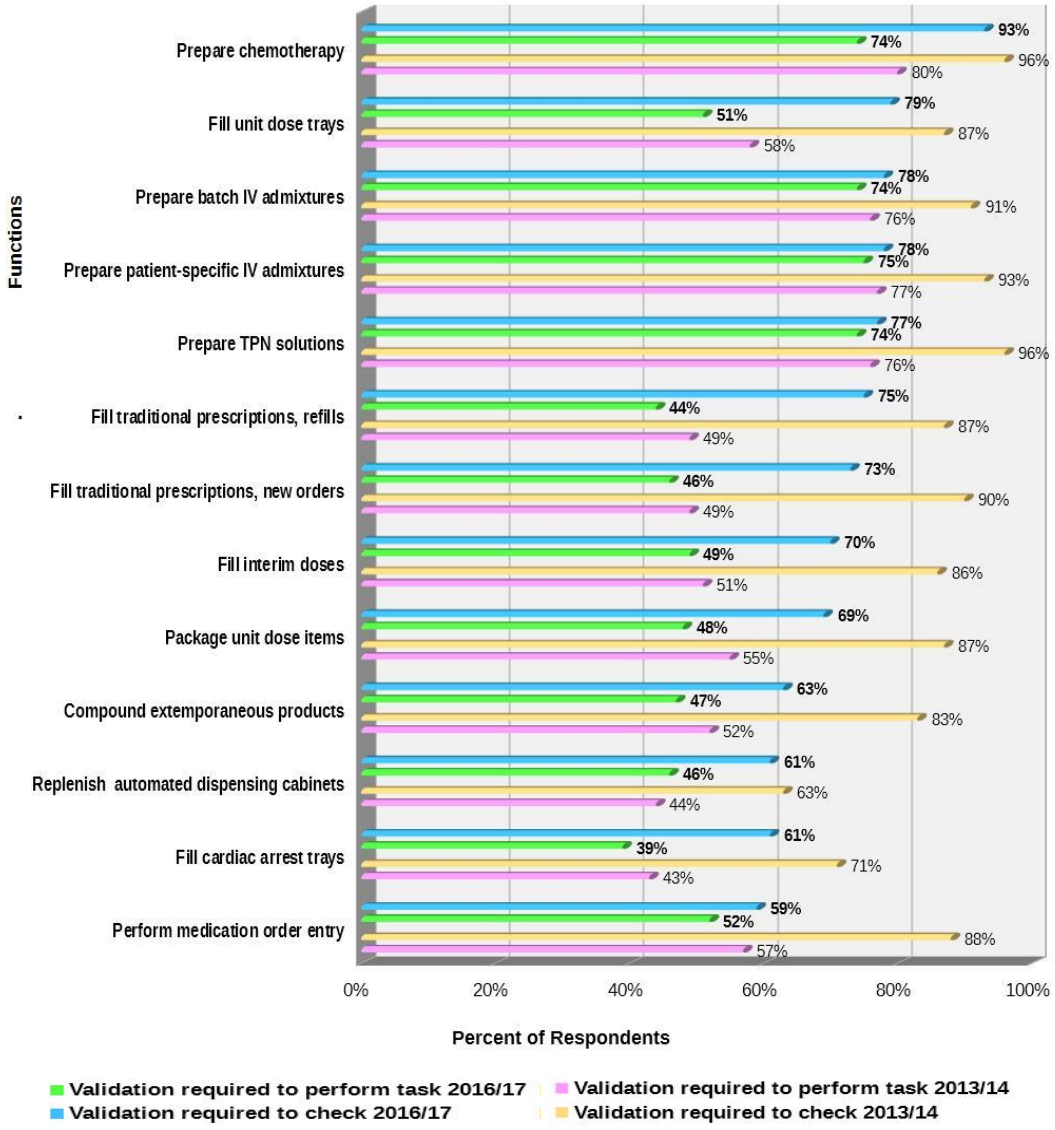


Base for 'Functions Checked by Technician (2016/17)': Respondents reporting that technicians perform that activity (Table F-1, Column C, n=141 to184)
Base for 'Functions Checked by Technician (2007/08)': Respondents reporting that technicians perform that activity (Table D-5, Column C, n= 38 to 122)

A trend seen in the past two reports (2011/12 and 2013/14) was that validation was less commonly required to allow a pharmacy technician to perform a task than to check that task. The rationale for this difference would be that a greater degree of quality control is needed where the technician can give final approval to release a product to a patient than is the case when the final check of a technician's work is carried out by a pharmacist. However, the results of the 2016/17 survey (Figure F-2) seem to indicate a reversal of this trend. The requirement for technician validation to perform tasks was reported by fewer respondents in 2016/17 than in 2013/14 (decreases of 2 to 7 percentage points) for common activities, such as entering medication orders (decrease from 57% to 52%) and preparing chemotherapy (decrease from 80% to 74%). Similarly, the requirement for validation to check the work of others was reported by fewer respondents, ranging from 3 to 29 percentage points less than in 2013/14, even for activities perceived to carry higher risk, such as the preparation of chemotherapy (decrease from 96% to 93%) and TPN solutions (decrease from 96% to 77%). This trend reversal could be related to facilities employing regulated pharmacy technicians to either perform work within their scope of practice or check the work of non-regulated pharmacy technicians/assistants performing these duties. Following these trends in future surveys will assist in measuring the impact of pharmacy technician regulation on hospital pharmacy practice.

The validation requirement for pharmacy technicians checking the work of others decreased in 2016/17 relative to the previous four survey periods.

Figure F-2. Technician Validation Requirements for Performing and Checking, 2013/14 vs. 2016/17



Base for 'Validation required to perform task (2016/17)': Respondents reporting that technicians perform that activity (Table F-1, Column B, n=141 - 184)
Base for 'Validation required to check (2016/17)': Respondents reporting that activity is checked by technicians (Table F-1, Column D, n=10 -104)
Base for 'Validation required to perform task (2013/14)': Respondents reporting that technicians perform that activity (Table F-1, Column B, n=114-159)
Base for 'Validation required to check (2013/14)': Respondents reporting that technicians check that activity performed by technicians (Table F-1, Column D, n=17-128)

Pharmacy Technician Support for Clinical Pharmacy Services

For several years, pharmacy technicians have performed activities beyond those in drug distribution to support clinical pharmacy services in patient care areas. First investigating this aspect of practice in 2007/08, the survey has tracked the duties of technicians that directly support the pharmacist's role in clinical services. The roles that pharmacy technicians play in direct support of the pharmacist's clinical role are summarized in Table F-2.

More than 75% of respondents reported that pharmacy technicians performed tasks directly supporting clinical activities.

Table F-2. Support Roles for Pharmacy Technicians for Clinical Pharmacy Services, 2016/17

	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC	Prai	ON	QC	Atl
(n=)	(181)	(50)	(80)	(51)	(41)	(133)	(7)	(30)	(38)	(52)	(41)	(20)
Pharmacy technicians perform tasks that directly support pharmacists in carrying out their clinical activities	141 **78%**	39 **78%**	62 **78%**	40 **78%**	33 **80%**	102 **77%**	6	13 **43%**	30 **79%**	47 **90%**	35 **85%**	16 **80%**
Tasks performed by pharmacy technicians												
(n=)	(141)	(39)	(62)	(40)	(33)	(102)	(6)	(13)	(30)	(47)	(35)	(16)
Serve as the initial Pharmacy liaison for solving drug distribution problems	118 **84%**	37 **95%**	48 **77%**	33 **83%**	27 **82%**	86 **84%**	5	11 **85%**	26 **87%**	36 **77%**	31 **89%**	14 **88%**
Collect and collate information concerning the patient's pre-admission drug therapy at admission	101 **72%**	19 **49%**	47 **76%**	35 **88%**	29 **88%**	68 **67%**	4	10 **77%**	15 **50%**	36 **77%**	27 **77%**	13 **81%**
Create initial inpatient drug therapy documentation and discharge drug therapy plan at discharge	25 **18%**	7 **18%**	11 **18%**	7 **18%**	7 **21%**	16 **16%**	2	2 **15%**	3 **10%**	5 **11%**	9 **26%**	6 **38%**
Collect laboratory test results to support drug therapy evaluation and monitoring	28 **20%**	4 **10%**	12 **19%**	12 **30%**	11 **33%**	17 **17%**	0	7 **54%**	3 **10%**	1 **2%**	13 **37%**	4 **25%**
Assemble pamphlets and documentation to be given to the patient during medication counselling	18 **13%**	5 **13%**	8 **13%**	5 **13%**	4 **12%**	11 **11%**	3	2 **15%**	2 **7%**	3 **6%**	6 **17%**	5 **31%**
Calculate changes to parenteral nutrition therapy	10 **7%**	3 **8%**	3 **5%**	4 **10%**	4 **12%**	6 **6%**	0	2 **15%**	1 **3%**	1 **2%**	2 **6%**	4 **25%**
Collate information for preparation of drug formulary submissions; non-compliance with formulary rules	25 **18%**	9 **23%**	7 **11%**	9 **23%**	3 **9%**	21 **21%**	1	2 **15%**	2 **7%**	10 **21%**	6 **17%**	5 **31%**
Assist in collecting data for presentation to the Medication Safety Committee	58 **41%**	18 **46%**	27 **44%**	13 **33%**	7 **21%**	50 **49%**	1	2 **15%**	11 **37%**	29 **62%**	7 **20%**	9 **56%**
Collect data for drug utilization review to support the drug use evaluation program	30 **21%**	14 **36%**	7 **11%**	9 **23%**	4 **12%**	24 **24%**	2	1 **8%**	5 **17%**	13 **28%**	6 **17%**	5 **31%**
Manage investigational drug inventory and provide technical assistance with clinical trial protocols	61 **43%**	9 **23%**	28 **45%**	24 **60%**	28 **85%**	27 **26%**	6	2 **15%**	10 **33%**	24 **51%**	17 **49%**	8 **50%**

Base: Facilities where pharmacy technicians perform tasks that directly support pharmacists in carrying out their clinical activities
Note: multiple mentions permissible
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

- In the 2016/17 survey, 78% (141/181) of all respondents reported that pharmacy technicians performed tasks directly supporting pharmacists in carrying out their clinical activities, similar to the 77% (123/160) reported for 2013/14. The results ranged from 43% (13/30) in BC to 90% (47/52) in ON.

The involvement of pharmacy technicians in clinical support activities has remained relatively stable since 2010/11.

- Responses concerning specific clinical support tasks have remained relatively stable over the past three reports, although there has been substantial regional disparity. For example, collection and collation by technicians of patients' pre-admission medication history at the time of admission was reported by 50% (15/30) of Prairie respondents, but at least 77% of respondents from all other regions. Also, creation of the initial inpatient drug therapy documentation and drug therapy discharge plan by a technician was reported by 38% (6/16) of Atlantic respondents but only 10% (3/30) of Prairie respondents and 11% (5/47) of ON respondents.

- A new question in the 2016/17 survey revealed that 43% (61/141) of respondents have technicians managing investigational drug inventory and assisting with study protocols. This role was the third most common clinical support activity for technicians, after serving as initial contact for drug distribution issues on patient care units (84%, 118/141) and contributing to medication histories at admission (72%, 101/141). Technician duties related to investigational drug services were reported most often by facilities with more than 500 beds (60%, 24/40), by all responding pediatric facilities (6/6) and by teaching hospitals (85%, 28/33).

As the transition toward employing more regulated pharmacy technicians continues, future reports in this series and the healthcare literature more generally will continue to track the impact of technicians' contributions to the support of clinical pharmacists and patient care services.

Technician Licensing through a Regulatory Authority

The 2013/14 survey measured the uptake of regulated/licensed pharmacy technicians within hospital practice in the five provinces where legislation had been enacted and implementation was underway (BC, AB, MB, ON, NS), albeit at different stages of completion. As of March 31, 2017 (the cut-off date for collection of information in the 2016/17 report), legislation was in place in nine provinces protecting the title of Pharmacy Technician and conferring regulatory authority over the practice of pharmacy technicians on the respective provincial colleges or boards of pharmacy, with competency assessment being provided by the PEBC. Table F-3 summarizes responses to the question "Has your organization or facility completed the transition to employment of regulated pharmacy technicians?" and shows the percentage of pharmacy technician staff regulated/licensed by a provincial regulatory authority.

Table F-3. Regulated/Licensed Pharmacy Technicians, 2016/17

		All	Hospital Type			Province Legislation In Place as of March 31, 2017							
						yes							no
			Teaching	Non-teaching	Pediatrics	BC	AB	SK	MB	ON	NB/PE	NS/NL	QC
Facility had completed the transition to employment of Regulated Pharmacy Technicians	(n=)	(179)	(40)	(132)	(7)	(29)	(18)	(7)	(13)	(52)	(9)	(12)	(38)
		100	24	72	4	22	18	2	6	50	0	2	0
		56%	**60%**	**55%**		**76%**	**100%**		**46%**	**96%**		**17%**	**0%**
Base: All respondents													
Percentage of staff who perform technical functions are Regulated Pharmacy Technicians	(n=)	(100)	(24)	(72)	(4)	(22)	(18)	(2)	(6)	(50)	(0)	(2)	(0)
	less than 10%	6	2	4	0	0	0	0	6	0	0	0	0
		6%	**8%**	**6%**		**0%**	**0%**			**0%**			
	10 to 50%	4	3	1	0	1	0	1	0	0	0	2	0
		4%	**13%**	**1%**		**5%**	**0%**			**0%**			
	51 to 90%	30	10	18	2	7	18	1	0	4	0	0	0
		30%	**42%**	**25%**		**32%**	**100%**			**8%**			
	greater than 90%	60	9	49	2	14	0	0	0	46	0	0	0
		60%	**38%**	**68%**		**64%**	**0%**			**92%**			

Base: Facilities that had completed the transition to employment of Regulated Pharmacy Technicians
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

- Overall, 56% (100/179) of respondents reported that they had completed the transition to employment of regulated pharmacy technicians. This represents a sharp decline from 93% (94/101) in the 2013/14 report, which included results for only the five provinces where pharmacy technician regulation was in progress (BC, AB, MB, ON, NS). The drop in the overall percentage of regulated/licensed pharmacy technicians in 2016/17 may be because some provinces (SK, NB, PE, NL) were still in transition while existing non-regulated pharmacy assistants were completing requirements for licensure as technicians. In addition, survey respondents (see Table F-6) in some provinces reported that they have decided to employ a mix of pharmacy technicians and pharmacy assistants on their pharmacy teams, thereby diluting the percentage of regulated pharmacy technicians in certain regions.

The percentage of respondents reporting the performance of technical functions by more than 90% of regulated technicians has almost tripled (from 21% to 60%) since 2013/14.

- Overall, 60% (60/100) of facilities reported that more than 90% of technical work was being carried out by registered pharmacy technicians, substantially higher than the 21% (20/94) who reported this level of involvement by registered pharmacy technicians in 2013/14. This practice was

reported by 92% (46/50) and 64% (14/22) of respondents in ON and BC, respectively. In Alberta, 51% to 90% of technical functions were performed by regulated technicians in 100% (18/18) of facilities.

Table F-4. Recognition and Support for Technician Certification and Regulation, 2016/17

		All	Hospital Type			Province							
						Legislation In Place as of March 31, 2017							
						yes							no
			Teaching	Non-teaching	Pediatrics	BC	AB	SK	MB	ON	NB/PE	NS/NL	QC
Educational sessions have been provided to inform pharmacy technicians of the changing environment	(n=)	175	40	128	7	29	18	7	13	51	9	12	35
		126	32	89	5	27	17	6	11	43	9	10	3
		72%	**80%**	**70%**		**93%**	**94%**		**85%**	**84%**		**83%**	**9%**
Revised pharmacy technician job descriptions require that all new hires must have certification	(n=)	176	40	129	7	29	18	7	13	52	9	12	35
		116	26	86	4	28	18	6	6	52	4	1	1
		66%	**65%**	**67%**		**97%**	**100%**		**46%**	**100%**		**8%**	**3%**
Existing pharmacy technicians are, or shortly will be, required to have certification	(n=)	174	40	127	7	28	18	7	13	51	9	12	35
		104	26	74	4	27	18	7	0	47	2	3	0
		60%	**65%**	**58%**		**96%**	**100%**		**0%**	**92%**		**25%**	**0%**
Financial support is being provided to pharmacy technicians in the facility who wish to become certified	(n=)	174	40	127	7	29	18	7	13	50	9	12	35
		108	22	82	4	21	15	4	9	39	8	11	0
		62%	**55%**	**65%**		**72%**	**83%**		**69%**	**78%**		**92%**	**0%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Table F-4 presents data on recognition and support for certification and regulation of pharmacy technicians in the 9 provinces that had adopted relevant legislation as of March 31, 2017.

- The proportion of respondents reporting that technician job descriptions had been revised, requiring that all new hires be regulated pharmacy technicians, was 66% (116/176). This represents an increase from 53% (86/162) in 2013/14 and 44% (73/166) in 2011/12.

- Overall, 62% (108/174) of respondents reported that financial support was being provided to pharmacy technicians who wished to become regulated. This represents a surge from 34% (55/161) in 2013/14 and 45% (73/162) in 2011/12. NS/NL respondents were more likely to report offering financial support (92%, 11/12) than those in ON (78%, 39/50), BC (72%, 21/29), Saskatchewan (4/7), and QC (0%, 0/35).

Two-thirds of respondents reported that job descriptions for pharmacy technician had been revised and that all new hires must have PEBC or similar certification.

Pharmacy Technician Workforce Integration

Legislation to regulate pharmacy technicians has now been enacted in all provinces except QC. Given existing evidence and experience with the expanded scope of pharmacy technician practice, it is anticipated that the professional authority granted to pharmacy technicians will support their roles and responsibilities within hospital pharmacy teams. Decisions about whether to employ only regulated pharmacy technicians or a mix of regulated and non-regulated staff will result in a heterogeneous blend of pharmacy staff. Survey questions to explore how these regulatory changes have affected pharmacy departments were introduced in 2011/12 and revised in subsequent surveys. Table F-5 examines the degree to which hospital pharmacy departments have made decisions about staff who will not qualify to register as Pharmacy Technicians and the nature of these decisions. Future hiring practices in the environment of regulated pharmacy technicians are reported in Table F-6.

- Overall, 72% (128/177) of respondents indicated that they had made decisions about the future of previously employed pharmacy technicians who fail to become regulated as Pharmacy Technicians and will no longer be allowed to use that title. This proportion is similar to 80% (81/101) in 2013/14 and up from 53% (88/166) in 2011/12. The highest reported decision rates (90%–100%) occurred in areas where pharmacy technician regulation had been in place for longer periods (AB, ON, BC, MB), although NS/NL was not far behind, at 75% (9/12).

Table F-5. Individuals Who Do Not Become Registered as Pharmacy Technicians, 2016/17

	All	Hospital Type			Province							
					Legislation In Place as of March 31, 2017							
					yes							no
		Teaching	Non-teaching	Pediatrics	BC	AB	SK	MB	ON	NB/ PE	NS/ NL	QC
(n=)	(177)	(40)	(130)	(7)	(29)	(18)	(7)	(13)	(52)	(9)	(12)	(36)
Facility has made decisions concerning the future of previously employed 'Pharmacy Technicians' who fail to qualify for licensure	128 **72%**	27 **68%**	97 **75%**	4	26 **90%**	18 **100%**	5	12 **92%**	51 **98%**	7	9 **75%**	0 **0%**
Base: All respondents												
Employment treatment of former pharmacy technicians who do not qualify for registration as Regulated Pharmacy Technicians												
(n=)	(128)	(27)	(97)	(4)	(26)	(18)	(5)	(12)	(51)	(7)	(9)	(0)
Their employment with your facility will be terminated.	46 **36%**	7 **26%**	36 **37%**	3	0 **0%**	14 **78%**	0	0 **0%**	30 **59%**	2	0	0
They will be offered positions elsewhere in the organization where registration as a pharmacy technician is not required.	40 **31%**	12 **44%**	27 **28%**	1	21 **81%**	2 **11%**	1	0 **0%**	15 **29%**	0	1	0
They will be given a new title and continue to work in the pharmacy department.	38 **30%**	8 **30%**	30 **31%**	0	3 **12%**	2 **11%**	4	12 **100%**	6 **12%**	5	6	0
Not yet determined	4 **3%**	0 **0%**	4 **4%**	0	2 **8%**	0 **0%**	0	0 **0%**	0 **0%**	0	2	0
Base: Facilities where decisions have been made re pharmacy technicians in provinces with Pharmacy Technician license legislation in place												
Responsibilities of former pharmacy technicians who do not qualify for as a regulated pharmacy technician and will continue to work in the pharmacy department												
(n=)	(38)	(8)	(30)	(0)	(3)	(2)	(4)	(12)	(6)	(5)	(6)	(0)
They will continue to perform the same duties, with the exception of tasks that by law can only be performed by a regulated pharmacy technician.	32 **84%**	5	27 **90%**	0	2	0	4	12 **100%**	3	5	6	0
They will have a new position description that limits their responsibilities to very basic activities.	6 **16%**	3	3 **10%**	0	1	2	0	0 **0%**	3	0	0	0
Salary treatment of former pharmacy technicians who do not qualify as a regulated pharmacy technician and will continue to work in the pharmacy department												
(n=)	(37)	(8)	(29)	(0)	(3)	(2)	(4)	(11)	(6)	(5)	(6)	(0)
They will continue to be paid on the same salary scale as the regulated pharmacy technicians.	9 **24%**	2	7 **24%**	0	0	0	0	0 **0%**	2	3	4	0
They will be placed on a new salary scale and 'red-circled'.	10 **27%**	2	8 **28%**	0	1	0	4	4 **36%**	1	0	0	0
They will be placed on a new salary scale that will pay them less.	6 **16%**	3	3 **10%**	0	2	2	0	0 **0%**	2	0	0	0
Not yet determined	12 **32%**	1	11 **38%**	0	0	0	0	7 **64%**	1	2	2	0

Base: Facilities where former pharmacy technicians will be given a new title and continue to work in the pharmacy department in provinces with Pharmacy Technician license legislation in place
Where the "n' value was less than 10, percentages were not calculated to avoid potentially misleading comparisons

- Of respondents reporting that their institutions had made decisions about those who fail to become regulated as pharmacy technicians, 36% (46/128) indicated that employment of these personnel within the facility would be terminated, 31% (40/128) reported that these staff members would be offered positions elsewhere in the organization (outside pharmacy), and 30% (38/128) reported that these personnel would be retained under a new title, such as "Pharmacy Assistant".

Of respondents who will continue to employ non-regulated pharmacy personnel under a new title, 84% plan to have these personnel perform the same duties, with the exception of tasks that must be performed only by a regulated pharmacy technician

- Among the respondents who reported that they would give non-regulated staff a new title (e.g., Pharmacy Assistant), 84% (32/38) indicated that those personnel would continue to perform the same duties, with the exception of tasks that must be only performed by a regulated pharmacy technician.

- There appears to be variation in planned salaries for individuals with a new title, such as Pharmacy Assistant. About one-quarter (24%, 9/37) of respondents reported that their institutions will pay these

individuals on the same scale as regulated technicians, 27% (10/37) will place them on a new salary scale with "red-circling" (i.e., a holding rate of pay that is above the maximum range assigned to the job classification), and 16% (6/37) will place them on a lower pay scale. About one-third of respondents (32%, 12/37) indicated that the salary range for these individuals had not yet been decided at the time of the survey (down from 59% (10/17) in 2013/14).

Table F-6. Planned Pharmacy Technician Hiring Practices, 2016/17

	All	Hospital Type			Province							
					Legislation In Place as of March 31, 2017							
					yes							no
		Teaching	Non-teaching	Pediatrics	BC	AB	SK	MB	ON	NB/ PE	NS/ NL	QC
(n=)	(100)	(24)	(72)	(4)	(22)	(18)	(2)	(6)	(50)	(0)	(2)	(0)
Only registered pharmacy technicians will be hired to work in the department.	56	9	46	1	13	1	1	0	41	0	0	0
	56%	**38%**	**64%**		**59%**	**6%**			**82%**			
Regulated Pharmacy Technicians will be hired into "pharmacy technician" positions, and non-regulated pharmacy technicians will be hired to work in other positions.	38	14	21	3	7	17	1	6	7	0	0	0
	38%	**58%**	**29%**		**32%**	**94%**			**14%**			
not yet determined	6	1	5	0	2	0	0	0	2	0	2	0
	6%	**4%**	**7%**		**9%**	**0%**			**4%**			

Base: Facilities where decisions have been made re pharmacy technicians in provinces with Pharmacy Technician license legislation in place
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

- Of respondents reporting that their institutions had completed the transition, 56% (56/100) stated that they would be hiring only regulated pharmacy technicians, 38% (38/100) reported that they would employ both regulated technicians and non-regulated pharmacy assistants, and 6% (6/100) had not yet determined their hiring approach (Table F-6). A regulated-technicians-only approach was in place in 82% (41/50) of ON facilities and 59% (13/22) of BC facilities, but only 8% (2/26) of Prairie facilities. The number of QC and Atlantic sites that had completed implementation was insufficient to allow assessment of planned hiring practices.

Pharmacy Technician Salaries

For a summary and discussion of pharmacy technician salaries, see Chapter D, Human Resources.

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G - Technology

Allan Mills

The incorporation of technology into healthcare is an important step toward improving quality of care and patient safety. Since 1999, published reports[1,2,3] have indicated the existence of systemic safety risks in healthcare and have articulated opportunities for action that could greatly improve the quality of healthcare in North America. In its landmark report entitled *Crossing the Quality Chasm*: *A New Health System for the 21st Century*, the US Institute of Medicine provided a framework for enhancing care and addressing quality concerns.[3] This report indicated that communication systems and information technology could be leveraged to improve healthcare. Further calls for action and project demonstrations have helped to foster increased automation and utilization of technologies. In the United States, these initiatives have been shared and incentivized to promote their adoption. Technologies and systems such as smart pumps,[4] computerized practitioner order entry (CPOE), closed-loop medication systems,[5] and electronic health records[6] have been touted as system changes that would foster quality improvement in healthcare.

In a 2012 report, the Conference Board of Canada noted that Canadian hospitals have been slower than their US counterparts to adopt technology,[7] and have fewer technology-enabled systems available for healthcare providers. The adoption of technology in and of itself can be a challenge. In addition, the financial costs, the potential reluctance of healthcare providers and a lack of infrastructure supports can all slow adoption of technology.

The 2011/12 Hospital Pharmacy in Canada Report noted that certain technologies and innovations such as TALLman lettering were being adopted readily, while others such as CPOE were progressing more slowly. This chapter of the 2016/17 report highlights the progress of Canadian healthcare organizations in adopting these technologies and system enhancements.

Systems Integration: Availability of Laboratory Test Results and Other Patient Information

Access to laboratory test results by pharmacists at the time of dispensing medications has the potential to reduce risks associated with medication therapy and to improve outcomes.[8] In previous iterations of the Hospital Pharmacy in Canada Survey, some organizations indicated that laboratory values were not electronically available to pharmacists as part of the order review process.

Table G-1. Pharmacist Access to Laboratory Results, 2016/17

	All	Bed Size			Hospital Type		
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics
How pharmacists obtain access to laboratory test results. (n=)	(184)	**(50)**	**(81)**	**(53)**	**(41)**	**(136)**	**(7)**
Through view-only access available at pharmacy terminals (interface or separate log-in)	116	33	53	30	31	80	5
	63%	**66%**	**65%**	**57%**	**76%**	**59%**	
Through laboratory system that is fully interfaced with medication order entry system	68	17	28	23	10	56	2
	37%	**34%**	**35%**	**43%**	**24%**	**41%**	

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Respondents reported that paper-based systems are no longer used to access laboratory data during the dispensing process.

The current results indicate that all respondents now have electronic access to laboratory data (Table G-1). However, there has been a decline in the number of respondents with access to laboratory data that are fully interfaced with the medication order entry system and a rise in stand-alone electronic (non-interfaced) systems for accessing data: from 49% (82/169) of respondents in 2011/12 to 37% (68/184) in 2016/17. This reduction occurred in both teaching and non-teaching hospitals, and was observed in hospitals with more than 500 beds and those with 201–500 beds (smaller hospitals were not part of this trend). Although the overall increase in electronic access can be seen as a positive development, increased reliance on stand-alone systems could suggest that more pharmacy practitioners are taking additional steps to access laboratory data during their review of drug therapy. Changes in access to CPOE may offset this limitation, but organizations are encouraged to work toward giving clinicians unencumbered access to all of the laboratory data that they need during review of drug therapy.

Safety Initiatives: TALLman Lettering

TALLman lettering is used to decrease the chances of selecting the wrong medication. It has been shown to make similar (look-alike) drug names easier to distinguish, and has been proven to reduce errors when such products are used.[9]

TALLman lettering is used extensively in hospital pharmacies and is starting to be used more widely outside the pharmacy department.

Survey results clearly indicated widespread adoption of TALLman lettering within the pharmacy environment (Table G-2), regardless of hospitals' teaching status or number of beds. Respondents reported use of TALLman lettering in the pharmacy information system (94%, 164/175) and on pharmacy-generated labels (95%, 166/175), unit-dose packaging (88%, 154/175) and medication administration records (85%, 148/175). The use of TALLman lettering was less evident for pharmacy shelf labels (69%, 121/175). Relative to 2011/12, the use of TALLman lettering increased substantially in two particular contexts: by 25 percentage points for medication carts, from 29% (40/136) in 2011/12 to 54% (94/175) in 2016/17; and by 24 percentage points for medication rooms, from 38% (52/136) in 2011/12 to 62% (108/175) in 2016/17. These trends indicate that TALLman lettering is starting to be more widely used outside of the pharmacy department.

Table G-2. TALLman Lettering, 2016/17

	All	Bed Size			Hospital Type		
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics
Facility uses TALLman lettering to reduce errors caused by confusion between drug products with look-alike drug names (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)
	176	49	77	50	40	129	7
	96%	**98%**	**95%**	**94%**	**98%**	**95%**	
Base: All respondents							
Where TALLman lettering is used (n=)	(175)	(49)	(77)	(49)	(40)	(128)	(7)
On pharmacy-generated labels	166	46	73	47	39	120	7
	95%	**94%**	**95%**	**96%**	**98%**	**94%**	
In the Pharmacy Information System (PIS)	164	46	71	47	38	119	7
	94%	**94%**	**92%**	**96%**	**95%**	**93%**	
On pharmacy-generated unit dose packaging	154	43	68	43	38	109	7
	88%	**88%**	**88%**	**88%**	**95%**	**85%**	
On Pharmacy-generated Medication Administration Records (MARs)	148	41	63	44	33	108	7
	85%	**84%**	**82%**	**90%**	**83%**	**84%**	
On shelf labels in the pharmacy	121	32	59	30	31	83	7
	69%	**65%**	**77%**	**61%**	**78%**	**65%**	
In the medication rooms on patient care units (e.g., shelf labels)	108	28	54	26	26	77	5
	62%	**57%**	**70%**	**53%**	**65%**	**60%**	
On medication carts	94	20	47	27	24	64	6
	54%	**41%**	**61%**	**55%**	**60%**	**50%**	
Within the CPOE environment (if applicable)	27	4	13	10	10	16	1
	15%	**8%**	**17%**	**20%**	**25%**	**13%**	

Base: Facilities using TALLman lettering
Note: multiple mentions permissible
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

The use of TALLman lettering in CPOE systems, measured for the first time in 2016/17, was relatively low (21%, 36/175). This may reflect the low rate of implementation of CPOE and is an area for future consideration by healthcare organizations.

Only 21% of CPOE systems appear to use TALLman lettering.

Safety Initiatives: Computerized Practitioner Order Entry Systems

CPOE systems have been the focus of attention and resources since the Institute of Medicine's 1999 report on medical errors and its call to improve safety in healthcare.[1] CPOE has been promoted as a means to reduce harm to patients and to create efficiencies in healthcare systems, including the Canadian healthcare system. The Canada Health Infoway was established to target effective use of digital health platforms in Canada, and by the start of 2017, an estimated Can$2.15 billion had been spent on this process.[10] It has been estimated that by 2010 the US government had provided US$27 billion for electronic health records.[11]

The 2011/12 Hospital Pharmacy in Canada Report showed some growth in CPOE system implementation relative to earlier surveys, but very few respondents indicated adoption of fully functional CPOE systems: from 5% (9/165) in 2007/08 to 8% (13/169) in 2011/12. According to the current survey, the number of Canadian facilities with a fully implemented CPOE system has more than tripled since 2007/08, to 17% (31/184) in 2016/17 (Table G-3).

Table G-3. Computerized Practitioner Order Entry, 2016/17

	All	Bed Size			Hospital Type		
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics
There is an operational computerized practitioner (or physician) order entry system (CPOE). (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)
Yes (there is an operational CPOE)	31	5	15	11	11	18	2
	17%	**10%**	**19%**	**21%**	**27%**	**13%**	
No, but there is an approved plan to implement CPOE	34	10	15	9	12	19	3
	18%	20%	19%	17%	29%	14%	
No, and there is not an approved plan to implement CPOE	119	35	51	33	18	99	2
	65%	70%	63%	62%	44%	73%	
Base: all respondents							
How CPOE system is interfaced to the PIS. (n=)	(31)	(5)	(15)	(11)	(11)	(18)	(2)
CPOE system is interfaced bidirectionally to the PIS	17	4	7	6	5	11	1
	55%		**47%**	**55%**	**45%**	**61%**	
CPOE system is interfaced unidirectionally to the PIS	8	0	6	2	3	5	0
	26%		**40%**	**18%**	**27%**	**28%**	
CPOE is not interfaced to PIS	6	1	2	3	3	2	1
	19%		13%	27%	27%	11%	
Base: facilities with an operational CPOE system							
Integration and use of a CPOE system (n=)	(31)	(5)	(15)	(11)	(11)	(18)	(2)
Alerts prescribers to unsafe orders during order entry	29	5	14	10	10	17	2
	94%		**93%**	**91%**	**91%**	**94%**	
Guides the use of formulary drugs	29	5	14	10	11	16	2
	94%		**93%**	**91%**	**100%**	**89%**	
Guides the use of weight-based or surface area based dosing for selected drugs and/or patient populations	29	4	15	10	10	17	2
	94%		**100%**	**91%**	**91%**	**94%**	
Guides the dosing of medications in special populations	25	4	14	7	8	15	2
	81%		**93%**	**64%**	**73%**	**83%**	
Is integrated with a clinical decision support system	20	3	9	8	7	11	2
	65%		**60%**	**73%**	**64%**	**61%**	
Is interfaced with the laboratory system to alert practitioners	20	4	9	7	5	13	2
	65%		**60%**	**64%**	**45%**	**72%**	

Base: facilities with an operational CPOE system
Note: multiple mentions permissible
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Certain types of facilities were more likely than others to have CPOE. For example, facilities with 201–500 beds (19%, 15/81) or more than 500 beds (21%, 11/53) were more likely to have CPOE than those with 50–200 beds (10%, 5/50), and teaching hospitals (27%, 11/41) and pediatric hospitals (2 of 7) were more likely to have CPOE than non-teaching hospitals (13%, 18/136) (Table G-3). Regionally, Ontario (ON) appears to be moving toward CPOE more quickly than other regions: overall, 56% (29/52) of respondents in that province reported either an operational CPOE system (29%, 15/52) or an approved plan to implement such a system (27%, 14/52).

The adoption of CPOE systems in Canada has more than tripled since 2007/08.

A sub-analysis was conducted to determine whether the Ontario responses were influenced by use of the Oncology Patient Information System developed by Cancer Care Ontario. This system is used by many cancer treatment centres, which could thus be construed as having a CPOE system in place; however, the results of this sub-analysis suggest that Ontario hospitals are also adopting core hospital information systems that use CPOE.

CPOE adoption appears to be highest in Ontario.

Implemented CPOE systems support safe prescribing through dosing guidelines.

Most of the core hospital CPOE systems were connected to the pharmacy information system by a bidirectional (55%, 17/31) or a unidirectional (26%, 8/31) interface. The most commonly reported purposes of CPOE systems were to support the use of formulary agents, to guide dosing for unsafe orders and to guide dosing based on height or weight (each reported by 94% of respondents, 29/31). CPOE systems were also used to support dosing guidelines for special populations (81%, 25/31) and to provide laboratory data (65%, 20/31) and clinical decision support (65%, 20/31). These results are similar to those from the 2011/12 survey.

After a decade, there was no measurable change in the number of facilities with no approved plan to implement CPOE.

Although the greater number of respondents with a CPOE system is encouraging, it must also be noted that 65% (119/184) of respondents reported that their organizations had no approved plan to implement CPOE. This result, similar to those obtained in 2011/12 (60%, 101/169) and 2009/10 (68%, 109/160), indicates that organizations with no plans to implement CPOE nearly 10 years ago have not changed their approach in the interim. Conversely, it appears that a number of the respondents who indicated in 2011/12 that they had an approved plan for CPOE have now completed the implementation.

By contrast, US hospitals have accelerated their use of CPOE systems. According to the 2016 survey of the American Society of Health-System Pharmacists, most organizations (90.7%) were using CPOE systems linked to a pharmacy information system.[12] Unlike the growth in the adoption of CPOE systems in the US, it appears that the situation in Canada remains unchanged from 2011/12, with a majority of Canadian facilities not having prioritized CPOE systems.

Safety Initiatives: Smart Pumps

Smart Pump use has increased over the past 10 years.

The adoption of smart pumps has increased steadily since the 2007/08 survey, with 89% (163/184) of current respondents indicating that they now have this technology (Table G-4, Table G-5). This trend is coupled with increases in the utilization of wireless technology to upload or download smart pump data, from 24% (30/125) in 2011/12 to 64% (103/162) in 2016/17, and in annual updating of the pump library, from 58% (72/125) in 2011/12 to 77% (125/163) in 2016/17. Although there were some regional differences in utilization, there seemed to be no differences based on teaching status or hospital size.

The use of wireless smart pumps is becoming standard practice.

All pediatric hospitals reported the use of wireless smart pumps.

All pediatric organizations completing the survey had fully implemented smart pumps with universal use of wireless capabilities and annual updating of pump libraries.

Table G-4 Smart Pumps, 2016/17

		All	Bed Size			Hospital Type		
			50 - 200	201- 500	>500	Teaching	Non-teaching	Pediatrics
Hospital uses Smart pumps	(n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)
		163	44	74	45	37	119	7
		89%	**88%**	**91%**	**85%**	**90%**	**88%**	
Base: All respondents								
Facility used a wireless network to upload or download data to smart pumps	(n=)	(162)	(43)	(74)	(45)	(36)	(119)	(7)
		103	25	49	29	30	66	7
		64%	**58%**	**66%**	**64%**	**83%**	**55%**	
Facility reviews and updates the drug-specific pump programming (i.e., the pump library) at least annually	(n=)	(163)	(44)	(74)	(45)	(37)	(119)	(7)
		125	31	57	37	31	87	7
		77%	**70%**	**77%**	**82%**	**84%**	**73%**	

Base: Facilities using Smart pumps
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Table G-5. Smart Pumps, 2007/08 to 2016/17

		2016/17	2011/12	2009/10	2007/08
Hospital uses smart pumps	(n=)	(184)	(176)	(160)	(165)
		89%	**75%**	**68%**	**61%**
Wireless network used to upload or download data to smart pumps	(n=)	(162)	(125)	(108)	(101)
		64%	**24%**	**30%**	**9%**
Pump specific libraries updated annually	(n=)	(163)	(125)	(107)	(101)
		77%	**58%**	**62%**	**43%**

Base: All respondents using smart pumps
For comparability the 2011/12 data in the above table have been modified to include pediatrics because in that report, pediatric data were reported separately
There was no technology data in 2013/14

Safety Initiatives: Barcoding

The use of barcoding in the medication distribution process is well supported by the literature. Evidence suggests that barcoding technology in the medication-use system can lead to a substantial reduction in errors.[13,14] When used at the bedside to confirm the patient's identification, at the point of dispensing from the pharmacy or when adding medications to packaging machines or automated dispensing cabinets, barcoding significantly reduces the risk of harm to patients.

Supports exist to increase the adoption of barcoding. The Institute for Safe Medication Practices Canada and the Canadian Patient Safety Institute have called for the adoption of barcoding technology and have developed a resource guide to support organizations as they look to implement this technology.[15] Generally, in all geographic regions, the use of barcoding technology has increased, indicating that these efforts have borne fruit.

The greatest use of barcoding technology was reported for pharmacy dispensing processes (Table G-6), especially verifying automated dispensing cabinets (65%, 96/148) and verifying stock in packaging machines (62%, 114/183). Use of barcoding to verify medications before dispensing was reported by 28% (52/183) of respondents, a small increase from 22% (37/167) in 2011/12. Verification of filling of unit-dose bins was reported by 28% (51/179) of respondents, up substantially from 11% (19/167) in 2011/12. These results suggest that the adoption of barcoding technology continues to increase in Canadian hospitals.

The use of barcode technology at the bedside to confirm patient identification is an effective method to reduce medication related harm.[16] The use of barcoding for medication administration has increased, with 12% (22/183) of respondents using positive patient identification and 12% (22/184) verifying the medication before administration, compared with 4% (7/167) and 3% (5/167), respectively, in 2011/12. The use of barcoding technology to identify staff administering medications was reported by 8% (16/184) of respondents, compared with 2% (3/167) in 2011/12. Although these increases are encouraging, there are still opportunities for improvement, with 13%–16% of respondents reporting that they have an approved plan for implementing this technology in the future.

The 45% (82/184) of respondents who reported using barcoding for inventory management is an increase from 2011/12 (28%, 47/167).

In 2016/17, 9% (16/178) of respondents reported using barcoding to transfer patient and/or drug information to smart pumps. Although adoption of barcoding for this purpose has increased from previous surveys, this continues to be an area of opportunity.

There was substantial regional variation in the use of barcoding technology. Quebec hospitals reported using barcoding to support repackaging, for filling automated dispensing cabinets and to verify the filling of unit-dose bins to a greater extent than other regions. Ontario had the highest responses for barcoded medication administration (identifying the patient, the medication and the staff member before administration), which may coincide with that province's increase in CPOE implementation.

Increased use of barcoding is an important step in improving patient safety and outcomes. In previous surveys, many respondents indicated plans to adopt barcoding, which translated into higher rates of implementation reported in subsequent surveys. In the current survey, most of the respondents who reported that their institutions had not yet adopted barcoding technology also indicated that they had no plans to do so. This could be an indication that the use of barcoding is unlikely to increase much further in the future.

Table G-6 Barcoding, 2016/17

Uses of Barcoding and Extent of Use	All	Bed Size			Hospital Type			Region				
		50-200	201-500	>500	Teaching	Non-teaching	Pediatrics	BC/YT	Prai	ON	QC	Atl
Verify stocking of automated dispensing cabinets (in facilities with ADCs) (n=)	(148)	(38)	(63)	(47)	(37)	(105)	(6)	(18)	(24)	(46)	(41)	(19)
Yes, we are using bar-coding for this application in 51%-100% of our facility	84	15	39	30	21	57	6	5	13	22	33	11
	57%	**39%**	**62%**	**64%**	**57%**	**54%**		**28%**	**54%**	**48%**	**80%**	**58%**
Yes, we are using bar-coding for this application in <50% of our facility	12	2	6	4	4	8	0	2	2	5	1	2
	8%	**5%**	**10%**	**9%**	**11%**	**8%**		**11%**	**8%**	**11%**	**2%**	**11%**
Verify stocking of automated re-packaging machines (n=)	(183)	(49)	(81)	(53)	(40)	(136)	(7)	(29)	(39)	(52)	(42)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	105	18	52	35	18	82	5	13	15	35	34	8
	57%	**37%**	**64%**	**66%**	**45%**	**60%**		**45%**	**38%**	**67%**	**81%**	**38%**
Yes, we are using bar-coding for this application in <50% of our facility	9	2	2	5	3	6	0	1	1	0	3	4
	5%	**4%**	**2%**	**9%**	**8%**	**4%**		**3%**	**3%**	**0%**	**7%**	**19%**
Inventory management (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(29)	(39)	(52)	(43)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	53	6	30	17	9	40	4	14	7	12	18	2
	29%	**12%**	**37%**	**32%**	**22%**	**29%**		**48%**	**18%**	**23%**	**42%**	**10%**
Yes, we are using bar-coding for this application in <50% of our facility	29	4	9	16	7	20	2	2	6	3	15	3
	16%	**8%**	**11%**	**30%**	**17%**	**15%**		**7%**	**15%**	**6%**	**35%**	**14%**
Verify filling of unit dose bins (n=)	(179)	(48)	(80)	(51)	(39)	(134)	(6)	(28)	(36)	(51)	(43)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	46	9	22	15	11	32	3	1	2	17	22	4
	26%	**19%**	**28%**	**29%**	**28%**	**24%**		**4%**	**6%**	**33%**	**51%**	**19%**
Yes, we are using bar-coding for this application in <50% of our facility	5	1	2	2	1	4	0	0	1	2	1	1
	3%	**2%**	**3%**	**4%**	**3%**	**3%**		**0%**	**3%**	**4%**	**2%**	**5%**
Verify drug selection before dispensing from the pharmacy (n=)	(183)	(50)	(80)	(53)	(41)	(135)	(7)	(29)	(39)	(51)	(43)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	44	4	25	15	7	34	3	1	3	12	25	3
	24%	**8%**	**31%**	**28%**	**17%**	**25%**		**3%**	**8%**	**24%**	**58%**	**14%**
Yes, we are using bar-coding for this application in <50% of our facility	8	0	3	5	2	6	0	0	0	4	4	0
	4%	**0%**	**4%**	**9%**	**5%**	**4%**		**0%**	**0%**	**8%**	**9%**	**0%**
Verify drug selection before administration to a patient (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(29)	(39)	(52)	(43)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	16	6	6	4	2	13	1	1	0	15	0	0
	9%	**12%**	**7%**	**8%**	**5%**	**10%**		**3%**	**0%**	**29%**	**0%**	**0%**
Yes, we are using bar-coding for this application in <50% of our facility	6	0	5	1	3	3	0	1	0	3	2	0
	3%	**0%**	**6%**	**2%**	**7%**	**2%**		**3%**	**0%**	**6%**	**5%**	**0%**
Identify the patient during medication administration (n=)	(183)	(50)	(80)	(53)	(41)	(135	(7)	(29)	(39)	(52)	(42)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	15	5	7	3	2	13	0	1	0	14	0	0
	8%	**10%**	**9%**	**6%**	**5%**	**10%**		**3%**	**0%**	**27%**	**0%**	**0%**
Yes, we are using bar-coding for this application in <50% of our facility	7	2	2	3	3	3	1	1	5	1	0	0
	4%	**4%**	**3%**	**6%**	**7%**	**2%**		**3%**	**13%**	**2%**	**0%**	**0%**
Identify the staff member during medication administration (n=)	(184)	(50)	(81)	(53)	(41)	(136)	(7)	(29)	(39)	(52)	(43)	(21)
Yes, we are using bar-coding for this application in 51%-100% of our facility	8	2	4	2	1	7	0	0	0	8	0	0
	4%	**4%**	**5%**	**4%**	**2%**	**5%**		**0%**	**0%**	**15%**	**0%**	**0%**
Yes, we are using bar-coding for this application in <50% of our facility	(8	2	3	3	4	3	1	0	6	2	0	0
	4%	**4%**	**4%**	**6%**	**10%**	**2%**		**0%**	**15%**	**4%**	**0%**	**0%**
Transfer patient- and/or drug-specific information to smart pump (n=)	(178)	(48)	(78)	(52)	(38)	(133)	(7)	(26)	(39)	(52)	(41)	(20)
Yes, we are using bar-coding for this application in 51%-100% of our facility	8	4	1	3	3	2	3	1	5	1	1	0
	4%	**8%**	**1%**	**6%**	**8%**	**2%**		**4%**	**13%**	**2%**	**2%**	**0%**
Yes, we are using bar-coding for this application in <50% of our facility	8	2	3	3	4	3	1	0	1	5	0	2
	4%	**4%**	**4%**	**6%**	**11%**	**2%**		**0%**	**3%**	**10%**	**0%**	**10%**

Base: All respondents
Where the "n" value was less than 10, percentages were not calculated to avoid potentially misleading comparisons.

Conclusions

The adoption of healthcare technology is believed to be an important step in improving patient care outcomes. Quality enhancement has already been achieved by effectively incorporating technology and standardization into care processes. Technologies such as electronic health records and CPOE are designed to effectively communicate information and data, thus allowing the healthcare team to make informed, effective decisions regarding treatment. Safe medication practices require the effective distribution and administration of medications, and their appropriate utilization and monitoring; all of these steps require effective communication and reliable data.

The results highlighted here suggest that progress continues to be made in the adoption of technology as part of pharmacy patient care processes. This progress is encouraging, especially with the adoption of medication-related technologies beyond the walls of the pharmacy (e.g., smart pumps, TALLman lettering). Increases reported for the use of barcoding technology and CPOE are also encouraging. Nonetheless, opportunities remain. The increase in CPOE implementation indicates that respondents who reported in 2011/12 that they planned to implement CPOE have carried out these plans. However, the 2016/17 data suggest that there may be few additional facilities with plans to implement CPOE and electronic health records, making future increases less likely. Sadly, this could mean that it will be a long time before technologies such as CPOE will be routinely used in all Canadian healthcare facilities.

The data suggest an encouraging pattern of continued adoption of these technologies, albeit at a potentially slower rate than previously anticipated. It is hoped that ongoing progress continues at an accelerated pace in order to support the quality, efficiency and safety of medication systems and processes.

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Appendix I - List of Tables and Figures

Chapter F – Pharmacy Technicians

Chapter G – Technology

Appendices

Appendix II - Recognition List

We wish to recognize all of the healthcare facilities in the list below for their willingness to contribute to the success of the 2016/17 Hospital Pharmacy in Canada Survey. Respondents from hospitals that appear in this list participated, or attempted to participate, in the survey by submitting data from their respective facility on or before August 1, 2017. Please note that some data from some respondents were not included in the analysis if the data provided were incomplete, insufficient or inconsistent with answers given to previous questions.

Hospitals 50-200 beds

Alberta Children's Hospital, Calgary, AB*
Battlefords Union Hospital, North Battleford, SK
Bethesda Hospital, Steinbach, MB
Boundary Trails Health Center, Winkler, MB
Cambridge Memorial Hospital, Cambridge, ON
Children's Hospital of Eastern Ontario, Ottawa, ON*
CIUSSS du Saguenay Lac-Saint-Jean, Hôpital de Dolbeau, Dolbeau-Mistassini, QC
Colchester East Hants Health Authority, Truro, NS
Collingwood General and Marine Hospital, Collingwood, ON
Concordia Hospital, Winnipeg, MB
Cornwall Community Hospital, Cornwall, ON
Cowichan District Hospital, VIHA, Duncan, BC
Cumberland Regional Health Care Centre, Amherst, NS
Cypress Regional Hospital, Swift Current, SK
Dartmouth General Hospital, Dartmouth, NS
Dauphin Regional General Hospital, Dauphin, MB
Delta Hospital, LMPS, Delta, BC
East Kootenay Regional Hospital, IHA, Cranbrook, BC
FH Wigmore Regional Hospital, Moose Jaw, SK
Guelph General Hospital, Guelph, ON
Guysborough Antigonish Strait Health Authority, CBR, Antigonish, NS
Headwaters Health Care Centre, Orangeville, ON
Hôpital de Montréal pour enfants, Montréal, QC*
Huron Perth Healthcare Alliance, Stratford, ON
Institut de cardiologie de Montréal, Montréal, QC*
Kootenay Boundary Regional Hospital, IHA, Trail, BC
Lake of the Woods District Hospital, Kenora, ON
Leduc Community Hospital, Leduc, AB
Lloydminster Hospital, PNRHA, Lloydminster, SK
Middlesex Health Alliance, Strathroy, ON
Miramichi Regional Hospital, Miramichi, NB*
Muskoka Algonquin HealthCare, Huntsville&Bracebridge, ON
Northern Lights Regional Health Centre, Fort McMurray, AB
Penticton Regional Hospital, IHA, Penticton, BC
Pictou County Health Authority, New Glasgow, NS
Prince County Hospital, Summerside, PE
Queen Elizabeth II Hospital, Grande Prairie, AB
Stollery Children's Hospitals, Edmonton, AB*
Sturgeon Community Hospital, St. Albert, AB
Thompson General Hospital, Thompson, MB
Timmins & District Hospital, Timmins, ON
UBC Hospital, LMHS, Vancouver, BC*
Vernon Jubilee Hospital, IHA, Vernon, BC
Victoria General Hospital, Winnipeg, MB
Victoria Hospital, PAPHR, Prince Albert, SK
West Parry Sound Health Centre, Parry Sound, ON

Hospitals 50-200 beds (continued)

Wetaskiwin Hospital and Care Centre, Wetaskiwin, AB
Whitehorse General Hospital, Whitehorse, YT
Woodstock General Hospital, Woodstock, ON
Yarmouth Regional Hospital (SWNSHA), Yarmouth, NS

Hospitals 201-500 beds

BlueWater Health, Sarnia, ON
Brandon Regional Health Centre, Brandon, MB
Brant Community Healthcare System, Brantford, ON
Burnaby Hospital, LMPS, Burnaby, BC
Campbell River Hospital, VIHA, Campbell River, BC
Campbellton Regional Hospital, Campbellton, NB
CH de Granby, CIUSSS de l'Estrie CHUS RLS Haute-Yamaska, Granby, QC
CH deSt-Marys, Montréal, QC
Chatham-Kent Health Alliance, Chatham, ON
CHAUR: Centre hospitalier affilié universitaire régional de Trois-Rivières, Trois-Rivieres, QC*
Children's & Women's Health Centre of BC, LMPS, Vancouver, BC*
Chilliwack Hospital, Fraser Canyon Hospital, LMPS, Chilliwack, BC
Chinook Regional Hospital, Lethbridge, AB
CHU Sainte-Justine, Montréal, QC*
CISSS Chaudière-Appalaches site Thetford, Thetford Mines, QC
CISSS Chaudière-Appalaches: St-Georges de Beauce, St-Georges, QC
CISSS du Bas-St-Laurent: CSSS Rivière-du-Loup, Rivière-du-Loup, QC
CISSS du Bas-St-Laurent: Hôpital Régional de Rimouski, Rimouski, QC
CISSS Montérégie-Est RLS Pierre-De Saurel, Sorel-Tracy, QC
CIUSSS Estrie-CHUS RLS La Pommeraie, Hôpital Brome-Missisquoi Perkins, Cowansville, QC
CIUSSS Sagenay-Lac-Saint-Jean, Hôpital d'Alma, Alma, QC
CIUSSS Saguenay-Lac-Saint-Jean, Hôpital de Jonquière, Jonquière, QC
CIUSSS Saguenay-Lac-Saint-Jean: Hôpital de Roberval, Roberval, QC
CSSS de Papineau, Gatineau, QC
CSSS lDOM (Hôpital général du Lakeshore), Pointe Claire, QC
Dr Everett Chalmers Regional Hospital, Fredericton, NB
Eagle Ridge Hospital, LMPS, Port Moody, BC
Edmundston Regional Hospital, Edmundston, NB
Georges Dumont Hospital CHU Dr Georges L Dumont, Moncton, NB

Hospitals 201-500 beds (continued)

Grace Hospital, Winnipeg, MB
Grey Bruce Health Services, Owen Sound, ON
Grey Nuns Community Hospital, Edmonton, AB*
HHS - Hamilton General Hospital, Hamilton, ON
HHS - Juravinski Hospital, Hamilton, ON
HHS - McMaster University Medical Centre, Hamilton, ON*
Hôpital de Montmagny, Montmagny, QC
Hôpital général de Montréal, Montréal, QC*
Hôpital Royal-Victoria, Montréal, QC*
Institut universitaire de cardiologie et de pneumologie de Québec (Université Laval), Sainte-Foy, QC*
IWK Health Centre, Halifax, NS*
Kelowna General Hospital, IHA, Kelowna, BC
Kingston Health Sciences Centre, Kingston, ON*
Langley Memorial Hospital, LMPS, Langley, BC
Markham-Stouffville Hospital, Markham, ON
Medicine Hat Regional Hospital, Medicine Hat, AB
Michael Garron Hospital - Toronto East Health Network, Toronto, ON
Misericordia Community Hospital, Edmonton, AB*
Sinai Health System, Toronto, ON*
Nanaimo Regional General Hospital, VIHA, Nanaimo, BC
North Bay Regional Health Centre, North Bay, ON
North York General Hospital, Toronto, ON
Peace Arch Hospital, LMPS, White Rock, BC
Queen Elizabeth Hospital, Charlottetown, PE
Queensway-Carleton Hospital, Ottawa, ON
Quinte Healthcare Corporation, Belleville, ON
Red Deer Regional Hospital, Red Deer, AB
Richmond General Hospital, LMPS, Richmond, BC
Ridge Meadows Hospital, LMPS, Maple Ridge, BC
Royal Columbian Hospital, LMPS, New Westminster, BC*
Royal Inland Hospital, IHA, Kamloops, BC
Royal Jubilee Hospital, VIHA, Victoria, BC*
Royal Victoria Regional Health Centre, Barrie, ON
Saint John Regional Hospital, Saint John, NB*
Sault Area Hospital, Sault Ste Marie, ON
Selkirk & District General Hospital, IRHA, Selkirk, MB
Seven Oaks General Hospital, Winnipeg, MB
South Health Campus, Calgary, AB*
Portage District General Hospital, Portage la Prairie, MB
SouthLake Regional Health Centre, Newmarket, ON
St. Joseph's Health Centre - Toronto, Toronto, ON
St. Michael's Hospital, Toronto, ON*
The Moncton Hospital, Moncton, NB*
The Scarborough and Rouge Hospital - Birchmount Site, Scarborough, ON
The Scarborough and Rouge Hospital - Centenary Site, Scarborough, ON
The Scarborough and Rouge Hospital - General Site, Scarborough, ON
Thunder Bay Regional Health Sciences Centre, Thunder Bay, ON
Toronto General Hospital (UHN), Toronto, ON*
Toronto Western Hospital (UHN), Toronto, ON*
University Hospital of Northern BC, Prince George, BC*
Victoria General Hospital, VIHA, Victoria, BC*
William Osler - Etobicoke General Hospital, Etobicoke, ON

Hospitals 500+ beds

Abbotsford Regional Hospital, Mission Memorial Hospital, LMPS, Abbotsford, BC
Cape Breton Healthcare Complex CBDHA), Sydney, NS
Central NL Regional HealthCare Center, Grand Falls-Windsor, NL
CH de l'Université de Montréal - CHUM, Montréal, QC*
CIUSSS de l'Estrie - CHUS (Sherbrooke), Magog, QC
CHU de Québec--Université Laval, Québec, QC*
CISSS de la Montérégie-Centre, St Jean sur Richelieu, QC
CISSS de Laval, Laval, QC
CISSSMO: Hôpital du Suroît, Salaberry-de-Valleyfield, QC
CIUSS-MCQ: Hôpital du centre de la Mauricie, Shawinigan, QC
CIUSSS Hôpital de Verdun, Montréal, QC
CIUSSS du Saguenay Lac-Saint-Jean, Hôpital de Chicoutimi, Chicoutimi, QC
CSSS de Gatineau, Gatineau, QC
CSSS de Saint-Jérôme, Saint-Jérôme, QC
CSSS du Nord de Lanaudière, Joliette, QC
Eastern Health Authority NL, St. John's, NL
Foothills Medical Centre, Calgary, AB*
Grand River Hospital, Kitchener, ON
Halton Healthcare: Oakville-Trafalgar, Milton, Georgetown, Oakville, ON
Hôpital Anna-Laberge (CISSSMO), Châteauguay, QC
Hôpital du Sacré-Cœur de Montréal, Montréal, QC*
Hôpital général juif, Montréal, QC*
Hôpital Lasalle-CIUSSS-ODIM, LaSalle, QC
Hôpital Pierre Boucher, Longueuil, QC
Hôpital Pierre-Boucher, Saint-Hyacinthe, QC
Hôpital Sainte-Croix, Drummondville, QC
Hôtel-Dieu D'Arthabaska, Victoriaville, QC
Hôtel-Dieu de Lévis (CISSS de Chaudière-Appalaches), Lévis, QC
Humber River Hospital, Toronto, ON
Lakeridge Health, Oshawa, ON
Lions Gate Hospital, LMPS, North Vancouver, BC
London Health Sciences Centre, London, ON*
Niagara Health System, St. Catharines, ON
Peter Lougheed Centre, Calgary, AB*
Peterborough Regional Health Centre, Peterbrough, ON
Providence Health Care Acute: St Paul's and Mt St Joseph Hospitals, LMPS, Vancouver, BC*
Queen Elizabeth II Health Sciences Centre, NSHA, Halifax, NS*
Queen's Park Care Centre, LMPS, New Westminster, BC
Regina Qu'Appelle Health Region, Regina, SK*
Rockyview General Hospital, Calgary, AB
Royal Alexandra Hospital, Edmonton, AB*
Saskatoon Health Region, Saskatoon, SK*
St. Boniface Hospital, Winnipeg, MB*
St. Joseph's Health Care, Hamilton, Hamilton, ON*
Surrey Memorial Hospital, LMPS, Surrey, BC
The Ottawa Hospital, Ottawa, ON*
Trillum Health Partners: Mississauga, Credit Valley and Queensway, Mississauga, ON*
University of Alberta Hospital/ Mazankowski Alberta Heart Institute, Edmonton, AB*
Vancouver General Hospital, LMPS, Vancouver, BC*
Western Memorial Health Authority, Corner Brook, NL
William Osler Health System/ Brampton Civic Hospital, Brampton, ON
Windsor Regional Hospital, Windsor, ON
Winnipeg Health Sciences Centre, Winnipeg, MB*

Appendix III - Key Ratios

The key ratios tabulated below can be used to carry out a high level comparison of a participating pharmacy department to those in similar hospitals across Canada, specifically for comparing pharmacy staffing, inventory turnover rates, and acute/non-acute drug costs. The ratios represent the mean of the results for the hospitals in each subgroup and are provided by hospital size and teaching status to allow pharmacy managers to compare their department to their closest peer group. Details on how the ratios have been calculated for a participating hospital that has provided sufficient data can be found in a pdf document that can be requested by the pharmacy manager at each participating hospital (by sending an e-mail to the Research Analyst, paul@pdora.com , with the subject line: 'Request for respondent questionnaire'). This pdf document contains not only the hospital's key ratios, but also the hospital's responses to each survey question. ***Please note that facility-specific data are available only to the participating hospital.***

Key Ratios 2016/17	Participating Facility's Ratio	All Hospitals	Pediatric Hospitals	Adult Hospitals					
				All Adult Hospitals	Bed Size			Teaching Status	
					50-200	201-500	>500	Teaching Hospitals	Non-teaching Hospitals
Inpatient budgeted hours per acute inpatient day	(n=)	(166)	(6)	(160)	(43)	(72)	(45)	(38)	(122)
		0.89	**1.82**	**0.85**	**0.79**	**0.87**	**0.89**	0.94	**0.83**
Inpatient budgeted hours per total (acute + non-acute) inpatient day	(n=)	(161)	(6)	(155)	(41)	(69)	(45)	(37)	(118)
		0.69	**1.76**	**0.66**	**0.69**	**0.66**	**0.61**	0.86	**0.59**
Total (inpatient + outpatient) budgeted hours per acute inpatient day	(n=)	(166)	(6)	(160)	(43)	(72)	(45)	(38)	(122)
		0.99	**1.90**	**0.95**	**0.85**	**0.96**	**1.03**	1.06	**0.92**
Total (inpatient + outpatient) budgeted hours per total (acute + non-acute) inpatient day	(n=)	(161)	(6)	(155)	(41)	(69)	(45)	(37)	(118)
		0.77	**1.83**	**0.73**	**0.74**	**0.73**	**0.71**	**0.97**	**0.65**
Inpatient technician + assistant FTE / inpatient pharmacist (staff + advanced) FTE	(n=)	(165)	(6)	(159)	(43)	(71)	(45)	(38)	(121)
		1.54	1.34	**1.55**	**1.67**	**1.45**	**1.59**	**1.36**	**1.61**
Pharmacist vacancy rate (weighted)	(n=)	(175)	(6)	(169)	(45)	(74)	(50)	(39)	(130)
		4.8%	**9.6%**	**4.6%**	**1.5%**	**4.1%**	**5.5%**	**5.0%**	**4.4%**
Inventory turnover rate	(n=)	(165)	(7)	(158)	(38)	(72)	(48)	(36)	(122)
		9.7	**9.6**	**9.7**	**7.2**	**10.3**	**10.8**	**10.6**	**9.5**
Acute care drug costs per acute patient day	(n=)	(134)	(6)	(128)	(31)	(60)	(37)	(35)	(93)
		$44.58	$76.70	$43.07	$31.84	$46.63	**$46.70**	**$51.05**	**$40.07**
Non-acute care drug costs per non-acute patient day	(n=)	(65)	(2)	(63)	(10)	(30)	(23)	(12)	(51)
		$13.23	**$4.99**	**$13.49**	**$22.20**	**$10.76**	$13.30	**$7.02**	**$15.01**

Notes