VALERIE LEUNG

The Blueprint for Pharmacy identified information and communication technology to be a key enabler for advancing pharmacy practice. We conducted this survey to gain further insight into how quality-of-care and productivity benefits of digital health have evolved within the context of pharmacy practice transformation.

Selon le Plan directeur pour la pharmacie, la technologie de l'information et des communications est un facteur clé de promotion de l'exercice de la pharmacie. Nous avons réalisé cette enquête pour mieux comprendre l'évolution de la qualité des soins et des gains de productivité qu'offre la santé numérique dans le contexte de la transformation de l'exercice de la pharmacie.

Canadian community pharmacists' use of digital health technologies in practice

Valerie Leung, BScPhm, ACPR, MBA; Sukirtha Tharmalingam, MHSc; Janet Cooper, BSc(Pharm), ACPR; Maureen Charlebois, CHE, MHSc, BScN

ABSTRACT

Background: In 2010, a pan-Canadian study on the current state and benefits of provincial drug information systems (DIS) found that substantial benefits were being realized and that pharmacists perceived DIS to be a valuable tool in the evolving models of pharmacy practice. To understand changes in digital health and the impact on practice since that time, a survey of community pharmacists in Canada was conducted.

Methods: In 2014, Canada Health Infoway (Infoway) and the Canadian Pharmacists Association (CPhA) invited community pharmacists to participate in a Web-based survey to understand their use and perceived benefits of digital health in practice. The survey was open from April 15 to May 12, 2014.

Results: Of the 447 survey responses, almost all used some form of digital health in practice. Those with access to DIS and provincial laboratory information systems (LIS) reported increased productivity and better quality of care. Those without access to these systems would overwhelmingly like access.

Discussion: There have been significant advances in digital health and community pharmacy practice over the past several years. In addition to digital health benefits in the areas of productivity and quality of care, pharmacists are also experiencing substantial benefits in areas related to recently expanded scope of practice activities such as ordering lab tests.

Conclusion: Community pharmacists frequently use digital health in practice and recognize the benefits of these technologies. Digital health is, and will continue to be, a key enabler for practice transformation and improved quality of care. *Can Pharm J (Ott)* 2016;149:38-45.

Background

Digital health refers to the use of information and communication technology, services and processes to deliver health care services or to facilitate better health. In Canada, this includes the electronic health record (EHR), which is the secure and lifetime record of a person's health and health care history, deployed by provinces and territories using a series of repository systems. These data assets store patient and provider demographics, diagnostic images, dispensed drugs, laboratory test results and clinical reports or immunizations.

It has been well established that to provide optimal patient care, pharmacists require access to patient-specific health care information, including medication profiles and laboratory values,^{1,2} yet evidence around the benefits of integrated health information systems for pharmacy practice is still emerging.³ In the United States, Health Information Exchange implementation pilots by the Department of Veterans Affairs are finding that clinicians, including pharmacists, are reporting positive changes in patient care and clinical practice as a result.⁴

In 2010, a pan-Canadian study on the current state and benefits of provincial drug information systems (DIS), the core component of the EHR that stores information about dispensed drugs, found that substantial benefits were being realized in the areas of access, quality and productivity and that pharmacists perceived the DIS to be a valuable tool in the evolving models of pharmacy practice. At the time of study, DIS had been fully implemented across Western Canada (British Columbia, Alberta, Saskatchewan and Manitoba) and in Prince Edward Island (PE), and access by community and hospital pharmacists was estimated to be nearly 100% in these provinces. The remainder of Canada was in a planning, pilot or early implementation phase.^{5,6}

Since that time, the landscape of digital health has continued to evolve with increasing adoption of electronic provincial DIS and other information and communication technologies by clinicians and patients. As of March 2014, the pan-Canadian average EHR availability was 89%, with 5 of 6 EHR components at or approaching 100% availability. In addition to fully implemented DIS in Western Canada and PE, significant progress had also been made in other jurisdictions; and overall availability of laboratory test results was more than 80% (Figure 1). The pace of EHR adoption, defined as having access to 2 or more integrated provincial data assets, had also accelerated substantially; in 2010, there were just fewer than 20,000 active users compared with over 62,000 by 2014.⁷

At the same time, the Blueprint for Pharmacy (Blueprint), a change management initiative with the purpose of achieving a vision of optimal drug therapy outcomes for Canadians through patient-centred care, continued to make significant progress.^{8,9} By 2014, as the result of developments in all key areas of the Blueprint for Pharmacy Implementation Plan, including information and communication technology, pharmacy practice had advanced considerably, with many expanded scope of practice services being implemented across Canada.^{9,10}

In order to gain insight into how digital health has contributed to and can continue to support pharmacy practice transformation, Canada Health Infoway (Infoway), in collaboration with the Canadian Pharmacists Association (CPhA), conducted a survey of community pharmacists' use and perceived benefits of digital health.

KNOWLEDGE INTO PRACTICE

- Pharmacists are reporting productivity and quality-of-care benefits as the result of technology such as provincial drug information systems (DIS) and laboratory information systems (LIS); 92% of pharmacists with access to DIS and 87% with LIS access stated better quality of patient care as a result.
- Future work in digital benefit realization for community pharmacists should focus on leveraging digital health in areas where scope of practice continues to expand.

Methods

A Web-based survey was developed by Infoway in partnership with CPhA for the purpose of understanding the current state of digital health use and benefits in community pharmacy practice. Following pretesting with a small group of pharmacists and revisions based on their feedback, the survey was administered by an independent consulting firm (Harris/Decima) with an online survey tool using commercial software (Confermit Horizons platform).

Convenience sampling was used to reach the target population over a 4-week period (April 15 to May 12, 2014). An invitation to participate and link to the online survey, available in English and French, was distributed via email by CPhA and 9 provincial pharmacy associations to their respective membership, potentially reaching 17,200 community pharmacists. Potential participants were made aware that their responses would be nonidentifiable and that only aggregate results would be provided to Infoway and CPhA. As this was an open survey, pharmacists were encouraged to distribute the link to their colleagues. Quebec was unable to participate due to survey timing and other jurisdictional priorities; Nunavut, Northwest Territories and Yukon were excluded from analysis of results, as there were only 2 responses from the territories.

The Web-based survey consisted of a brief introduction and included questions about respondent demographics, access and use of provincial DIS, laboratory information systems (LIS), other digital health technologies and their impact on pharmacy practice. For questions about impact on clinical practice, respondents were asked to indicate if they experienced any improvement regarding specific benefits (e.g., access to patient information) and to estimate the percent improvement as the result of DIS or LIS. While there was a total of 29 questions

MISE EN PRATIQUE DES CONNAISSANCES

- Les pharmaciens signalent que la technologie permet d'obtenir des gains de productivité et de qualité des soins, notamment grâce aux systèmes provinciaux d'information sur les médicaments (SIM) et aux systèmes d'information de laboratoire (SIL); 92 % des pharmaciens ayant accès à un SIM et 87 % de ceux ayant accès à un SIL ont indiqué une amélioration de la qualité des soins aux patients grâce à ces systèmes.
- Les travaux permettant de déterminer les avantages du numérique pour les pharmaciens communautaires devraient porter sur l'utilisation de la santé numérique dans les domaines où le champ d'exercice continue de s'élargir.

and 43 screens, adaptive questioning was used to streamline the survey. For example, only respondents who had previously practised in an environment without a DIS were presented with questions about changes they experienced since DIS implementation. The questionnaire was designed to be completed in 15 minutes and had a back button that allowed respondents to review and change their answers before submitting the survey. To encourage higher response rates, respondents were sent email reminders and they were eligible for a participation prize draw.

To achieve a representative sample, the data were weighted to adjust for the national

distribution of community pharmacists based on 2012 data from the Canadian Institute for Health Information.¹¹ Frequency distributions and descriptive statistics for survey questions were calculated using SPSS version 19.0 (SPSS, Inc., an IBM Company, Chicago, IL). Responses were included for individual questions even if the respondent did not respond to all survey questions. Methods and results have been reported in this study according to guidelines specific to Web surveys.¹²

Results

Respondents

Overall, 447 community pharmacists responded to the survey. This resulted in a completion rate of 47% (447 of 955), which represents the ratio of individuals who finished the online survey to those who agreed to participate. Ontario had the highest number of responses, followed by Saskatchewan and Alberta (Table 1). Table 2 provides additional details about respondents.

Access and use of digital health

Most respondents practise in a hybrid (paper and electronic) environment (86%), and almost all use electronic reminders (99%), the CPhA e-Therapeutics/eCPS electronic clinical decision support tool (88%) and other electronic clinical decision

FIGURE 1 Availability of electronic health record (EHR) information by jurisdiction (as of March 2014)

	Client Demographics	Provider Demographics	Diagnostic Images	Dispensed Drugs	Lab Test Results	Clinical Reports/Immunizations
PE	100%	100%	100%	100%	100%	100%
AB	100%	100%	100%	100%	100%	100%
BC	100%	100%	100%	100%	100%	100%
SK	100%	100%	100%	100%	99%	100%
MB	100%	100%	100%	100%	100%	100%
NL	100%	100%	100%	38%	100%	100%
NS	100%	100%	100%	25%	100%	100%
NB	100%	100%	100%	20%	100%	100%
NT	100%	100%	100%	0%	100%	100%
QC	100%	100%	100%	62%	60%	95%
ON	100%	100%	100%	25%	74%	100%
NU	100%	100%	80%	80%	90%	80%
YT	0%	0%	100%	0%	50%*	100%

An additional 45% of Yukon's lab tests are performed in British Columbia (BC) and digitally stored in BC's Provincial laboratory information system.

TABLE 1 Distribution of survey respondents

Province	Number of surveys completed* (%) (n = 447)
British Columbia	55 (12.3)
Alberta	65 (14.5)
Saskatchewan	97 (21.7)
Manitoba	20 (4.5)
Ontario	114 (25.5)
Nova Scotia	25 (5.6)
New Brunswick	21 (4.7)
Prince Edward Island	27 (6)
Newfoundland and Labrador	23 (5.1)

*Unweighted; percentages may not add up to 100% due to rounding.

tools for patient care (86%). Sixty-five percent of respondents have access to patient medication profiles through DIS, and 22% have access to laboratory test results through LIS. Of individuals who do not currently have access to DIS, 96% indicated that they would like access; for LIS, 91% of those without access desired access.

Drug information systems

Overall, 43% (192 of 447) of respondents practised in a province with a fully implemented DIS, and of these, 56% (107 of 192) had previously practised in an environment where no DIS was available. Almost 3 of 4 (74%) of these individuals believe that the DIS provides the required information to inform their practice, and just over half (52%) are accessing the DIS using integrated functionality within their local pharmacy system. The remainder are accessing the DIS through a Web viewer (37%) or through a third party or other application (11%).

When asked about the impact of having access to a DIS in their practice, the majority of respondents estimated more than 60% improvement in the following benefits: access to patient information, pharmacist prescribing activities, conducting medication reviews, continuity of patient care, targeting inappropriate medication use and potential drug-related problems, and performing medication reconciliation (Figure 2). While 61% of pharmacists reported increased pharmacist productivity since the availability of a DIS, 92% stated that the quality of patient care they are able to provide is better or much better (Figure 3).

Laboratory information systems

Twenty-three percent of community pharmacists (102 of 447) reported having access to electronic

laboratory test results through a provincial information system. Fifty-seven percent of these individuals reported increased productivity since having access to an LIS, and 87% indicated better or much better quality of patient care as a result (Figure 3).

Discussion

Community pharmacists in Canada are using and patients are benefitting from digital health in their practice. Nearly all respondents of this survey reported using some form of digital health, with 65% indicating that they use provincial DIS to view patient medication profiles. Forty-three percent of these pharmacists are practising in a province with a fully implemented DIS, and 23% have access to laboratory test results through a provincial information system.

As with a previous national survey of pharmacists conducted as part of the Pan-Canadian DIS study in 2010, community pharmacists continue to experience improved productivity, quality of care and clinical benefits as a result of having access to a provincial DIS. In addition, the number of clinical benefits that the majority of respondents estimated as being substantially better (greater than 60% improvement) has increased. In 2010, substantial improvement was seen in access to patient information, reduction in fraudulent medication use, medication management and reduced drug-related problems as the result of provincial DIS. In this survey, in addition to those clinical benefits, community pharmacists are now also experiencing substantial improvement in advanced use to support clinical practices such as pharmacist prescribing activities, medication reviews, medication reconciliation and continuity of patient care.^{5,6}

TABLE 2 Respondent characteristics

Respondent characteristics		Number (%) (n = 447)
Community practice setting	Chain/franchise	120 (26.8)
	Pharmacy located within large retail operation	82 (18.3)
	Banner	135 (30.2)
	Independently owned	110 (24.6)
Practice location	Urban/suburban	335 (74.9)
	Rural	112 (25.1)
Primary role	Staff pharmacist	217 (48.5)
	Pharmacy owner	107 (23.9)
	Pharmacist dispensary manager	106 (23.7)
	Other	17 (3.8)
Average prescriptions dispensed per day	Less than 100	112 (25.1)
	101-200	199 (44.5)
	201-300	67 (15)
	301-400	31 (6.9)
	More than 400	38 (8.5)
Years in pharmacy practice	5 or less	124 (27.7)
	6-20	141 (31.5)
	More than 20	182 (40.7)

Percentages may not add up to 100% due to rounding.

FIGURE 2 Pharmacist-reported clinical benefits of drug information systems (DIS)

n = 107 (respondents practising in a province with a fully implemented DIS and who previously practised without access to a DIS).

FIGURE 3 Pharmacist-reported impact of drug information systems (DIS) and laboratory information systems (LIS) on productivity and quality of care

For DIS, $n = 107$ (respondents practising in a province with a fully implemented DIS and have previously practised without access to a DIS). For LIS, $n = 102$ (respondents with access to electronic laboratory test results through an LIS).

Most with access to provincial LIS also reported a positive impact on pharmacist productivity, and virtually all reported better quality of care as a result.

These results are consistent with studies evaluating the impact of the EHR and its components on clinical practice from a jurisdictional perspective. A retrospective study in British Columbia found that implementation of the provincial DIS (PharmaNet) was associated with a sustained reduction in inappropriate prescriptions dispensed for opioid analgesics and benzodiazepines.¹³ A randomized control trial in Ontario found that incorporating information from a centralized provincial drug profile viewer into medication reconciliation processes decreased unintended discrepancies within best possible medication histories.¹⁴ In Alberta, community pharmacists have embedded the use of the provincial EHR (Alberta Netcare), which includes dispensing records and laboratory values, into their practice and are finding this to be an essential tool for patient care.¹⁵

The 2010 Pan-Canadian DIS study concluded that while provincial DIS were providing value to the evolving practice of pharmacy, realization of future benefits would require continued optimization and integration into practice to support the

provision of patient care.⁵ With respect to changing pharmacist roles, those surveyed in 2010 also identified electronic provincial DIS as most important in the areas of medication reconciliation and expanded prescribing authority.¹⁶ Since that time, a great deal of progress has been made in advancing pharmacists' expanded scope of practice across the country. By 2014, pharmacist adaptation of prescriptions, prescribing for ambulatory conditions and initiation of prescription drug therapy had been implemented in most provinces, and in some jurisdictions, pharmacists were also able to order and interpret lab tests.¹⁰ With funding by provincial governments now also in place for many pharmacist services, including medication reviews, the number of pharmacists providing these expanded services has grown from 42% in 2011 to 64% in 2014.^{17,18} For these reasons, it is not surprising that pharmacists using DIS are now reporting clinical benefits in these same areas and that those who currently do not have access to provincial DIS or LIS overwhelmingly would like access to help inform patient care.

This survey of community pharmacists provides valuable insight into how changes in pharmacy practice are reflected in the evolution of digital health benefits and corroborates previous

research that found that pharmacists with a patient-centred practice are more likely to use and benefit from an EHR, specifically with respect to accessing laboratory values.¹⁵ It also confirms our understanding that digital health such as DIS and LIS can support health care transformation when paired with policy changes.⁵ Future work on realizing digital health benefits in community pharmacy should focus on areas where scope of practice continues to progress, such as ordering and interpreting laboratory tests.¹⁰

Limitations

Certain limitations of these survey results should be acknowledged. First, open online surveys of this nature can be susceptible to bias due to convenience sampling and self-selection of respondents.¹² For instance, because the primary method of survey recruitment was through CPhA and provincial pharmacy associations, community pharmacists who are not members may not have had an opportunity to participate. In addition, Quebec did not participate in this survey and the territories were excluded from

analysis due to insufficient response. Therefore, although statistical correction was used to adjust for a nonrepresentative sample, it should be recognized that these survey findings provide a macroscopic view of digital health use and benefits in community pharmacy practice and should be interpreted in this context.

Conclusion

This survey of community pharmacists in Canada advances knowledge about the use and impact of digital health in community pharmacy practice today and how this has evolved over the past several years. Those who have access to digital health such as provincial DIS and LIS report considerable clinical benefits, increased productivity and better quality of patient care. Pharmacists without access to provincial DIS and LIS are in favour of obtaining access to support patient care. As the Blueprint for Pharmacy continues to progress and pharmacists' scope of practice continues to change, there will be numerous opportunities for digital health to support and accelerate this transformation. ■

From Canada Health Infoway, Toronto; and the Canadian Pharmacists Association, Ottawa, Ontario. Contact vleung@infoway-inforoute.ca.

Author Contributions: M. Charlebois, J. Cooper and S. Tharmalingam contributed to the study design and methodology. V. Leung and S. Tharmalingam conducted the data analysis and wrote the first draft of the manuscript. All authors contributed to interpreting study results, critical review of the manuscript and approved the final submission.

Declaration of Conflicting Interests: The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding: The authors received no financial support for the research, authorship and/or publication of this article.

References

1. Millonig MK, Jackson TL, Ellis WM. Improving medication use through pharmacists' access to patient-specific health care information. *J Am Pharm Assoc (Wash)* 2002;42:638-45.
2. van Lint JA, Sorge LA, Sorensen JD. Access to patients' health records for drug therapy problem determination by pharmacists. *J Am Pharm Assoc (2003)* 2015;55:278-81.
3. McKibbin KA, Lokker C, Handler SM, et al. Enabling medication management through health information technology (Evidence Report/Technology Assessment No. 201). Rockville (MD): Agency for Healthcare Research and Quality; 2011. Available: www.ahrq.gov/research/findings/evidence-based-reports/er201-abstract.html (accessed October 9, 2015).
4. Byrne CM, Mercincavage LM, Bouhaddou O, et al. The Department of Veterans Affairs' (VA) implementation of the Virtual Lifetime Electronic Record (VLER): findings and les-

sons learned from Health Information Exchange at 12 sites. *Int J Med Inform* 2014;83:537-47.

5. Deloitte. National Impacts of Generation 2 Drug Information Systems. Technical Report. 2010. Available: <https://www.infoway-inforoute.ca/en/component/edocman/resources/reports/331-national-impact-of-generation-2-drug-information-systems-technical-report-full?Itemid=101> (accessed April 15, 2015).

6. Leung V, Hagens S, Zelmer J. Drug information systems: evolution of benefits with system maturity. *Healthc Quart* 2013;16(2). Available: www.longwoods.com/content/23409 (accessed April 15, 2015).

7. Canada Health Infoway. Annual Report 2013-2014. Toronto (ON): Canada Health Infoway; 2014. Available: <https://www.infoway-inforoute.ca/en/component/edocman/resources/i-infoway-i-corporate/annual-reports/1957->

- annual-report-2013-2014?Itemid=101 (accessed April 15, 2015).
8. Canadian Pharmacists Association. Blueprint for Pharmacy: implementation plan. Ottawa (ON): Canadian Pharmacists Association; 2009. Available: http://blueprintforpharmacy.ca/docs/pdfs/blueprint-implementation-plan_final--march-2010.pdf (accessed April 15, 2015).
 9. Blueprint for Pharmacy Steering Committee. Blueprint for Pharmacy: our way forward. Ottawa (ON): Canadian Pharmacists Association; 2013. Available: <http://blueprintforpharmacy.ca/docs/pdfs/blueprint-priorities---our-way-forward-2013---june-2013.pdf> (accessed April 15, 2015).
 10. Canadian Pharmacists Association. Environmental scan: pharmacy practice legislation and policy changes across Canada. Ottawa (ON): Canadian Pharmacists Association; 2014. Available: <http://blueprintforpharmacy.ca/docs/kt-tools/environmental-scan---pharmacy-practice-legislation-and-policy-changes-may-2014.pdf> (accessed April 15, 2015).
 11. Canadian Institute for Health Information. Pharmacist workforce, 2012. Available: <https://secure.cihi.ca/estore/productFamily.htm?locale=en&pf=PFC2353> (accessed April 15, 2015).
 12. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of Internet e-surveys (CHERRIES). *J Med Internet Res* 2004; 6(3): e34. Available: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550605/> (accessed April 15, 2015).
 13. Dormuth CR, Miller TA, Huang A, et al. Effect of a centralized prescription network on inappropriate prescriptions for opioid analgesics and benzodiazepines. *CMAJ* 2012;184:E852-6.
 14. Fernandes O, Etchells E, Lee AW, et al. What is the impact of a centralized provincial drug profile viewer on the quality and efficiency of patient admission medication reconciliation? A randomized controlled trial [abstract]. *Can J Hosp Pharm* 2011;64:85.
 15. Hughes CA, Guirguis LM, Wong T, et al. Influence of pharmacy practice on community pharmacists' integration of medication and lab value information from electronic health records. *J Am Pharm Assoc (2003)* 2011;51:591-8.
 16. Canadian Pharmacists Association and Canada Health Infoway. The value of drug information systems to the evolving practice of pharmacy. 2011. Available: <http://blueprintforpharmacy.ca/docs/default-document-library/2011/03/11/124.pdf?Status=Master> (accessed April 15, 2015).
 17. Canadian Foundation for Pharmacy. 2014 Fees and claims for government-sponsored pharmacist services by province. Available: www.cfpnet.ca/bank/document_en/75-2013-chart.pdf (accessed October 14, 2015).
 18. Pharmacy Practice+. Community pharmacy trends & insights 2015. Toronto (ON): Rogers Publishing; 2015.