Barriers to a full scope of pharmacy practice in primary care: A systematic review of pharmacists' access to laboratory testing

Jacqueline Donovan, BMedSci, MPharm^{ID}; Ross T. Tsuyuki, BSc(Pharm), PharmD, MSc, FACC, FCSHP, FCAHS; Yazid N. Al Hamarneh, BSc(Pharm), PhD^{ID}; Beata Bajorek, BPharm, PhD, DipHospPharm, GradCertEdStud(HigherEd)

JACQUELINE DONOVAN

ABSTRACT

Objectives: To describe primary care pharmacists' current scope of practice in relation to laboratory testing.

Method: A 2-tiered search of key databases (PubMed, EMBASE, MEDLINE) and grey literature with the following MeSH headings: *prescribing, pharmacist/pharmacy, laboratory test, collaborative practice, protocols/guidelines*. We focused on Canada, the United States, the United Kingdom, New Zealand and Australia for this review.

Results: There is limited literature exploring primary care pharmacists' scope of practice in relation to laboratory testing. The majority of literature is from the United States and Canada, with some from the United Kingdom and New Zealand and none from Australia. Overall, there is a difference

in regulations between and within these countries, with the key difference being whether pharmacists access and/or order laboratory testing dependently or independently. Canadian pharmacists can access and/or order laboratory tests independently or dependently, depending on the province they practise in. US pharmacists can access and/or order laboratory tests dependently within collaborative practice agreements. In the United Kingdom, laboratory testing can be performed by independent prescribing pharmacists or dependently by supplementary prescribing pharmacists. New Zealand prescribing pharmacists can order laboratory testing independently. Most publications do not report on the types of laboratory tests used by pharmacists, but those that do predominantly resulted in positive patient outcomes.

Discussion/Conclusion: Primary care pharmacists' scope of practice in laboratory testing is presently limited to certain jurisdictions and is often performed in a dependent fashion. As such, a full scope of pharmacy services is almost entirely unavailable to patients in the United States, the United Kingdom, New Zealand and Australia. Just as in the case for pharmacists prescribing, evidence indicates better patient outcomes when pharmacists can access/order laboratory tests, but more research needs to be done alongside the implementation of local guidelines and practice standards for pharmacists who practise in that realm. Patients around the world deserve to receive a full scope of pharmacists' practice, and lack of access to laboratory testing is one of the major obstacles to this. *Can Pharm J (Ott)* 2019;152:317-333.

Patients deserve to receive pharmacists' full scope of practice, which includes laboratory testing, regardless of where they reside. Our research highlights the present barriers to achieving this around the world.

Où qu'ils résident, les patients méritent de bénéficier de toutes les compétences des pharmaciens, y compris de leurs compétences d'analyses de laboratoire. Notre étude présente les obstacles actuels à l'atteinte de cet objectif dans le monde.

Introduction

Pharmacists are easily accessible, trusted frontline primary health care providers who see patients

more frequently than any other health care professional.^{1,2} As such, they are well positioned to identify at-risk or poorly controlled patients and

© The Author(s) 2019

Article reuse guidelines:
sagepub.com/journals-permissions
DOI:10.1177/1715163519865759

KNOWLEDGE INTO PRACTICE

- As prescribing authority for pharmacists expands, opportunities exist to use primary care pharmacists' full scope of practice, including the ability to access and order laboratory testing and to develop standardized guidelines, frameworks and standards.
- Primary care pharmacists' scope of practice in laboratory testing is presently limited to certain jurisdictions and is often performed in a dependent fashion.
- There is also a lack of literature explicitly exploring primary care pharmacists' scope of practice in relation to laboratory testing. Future research should focus on exploring this area of pharmacy practice.
- Primary care pharmacists' involvement in laboratory testing has the potential to improve patient outcomes by facilitating prescribing and potentially reducing medication-related errors.

MISE EN PRATIQUE DES CONNAISSANCES

- Tandis que le pouvoir de prescription des pharmaciens s'étend, il existe des occasions de recourir à toutes les compétences des pharmaciens de soins primaires, notamment la possibilité d'accéder à des analyses de laboratoire et de demander de telles analyses, ainsi que d'élaborer des normes, des lignes directrices et des cadres normalisés.
- Le champ de pratique des pharmaciens de soins primaires relativement aux analyses de laboratoire est actuellement limité à certains territoires, souvent de manière dépendante.
- Il existe également peu de recherches se penchant explicitement sur le champ pratique des pharmaciens de soins primaires relativement aux analyses de laboratoire. Les recherches futures devraient s'attacher à examiner ce domaine de la pratique pharmaceutique.
- La participation des pharmaciens de soins primaires aux analyses de laboratoire pourrait améliorer la santé des patients en simplifiant la prescription et en réduisant éventuellement les erreurs de médicaments.

work with them to assist in their disease management. To perform this role in the best way possible, pharmacists must gather and interpret appropriate information (i.e., clinical parameters) to determine the best course of action for improving the patients' outcomes.³ Currently, primary care pharmacists can obtain these clinical parameters by referring a patient to a physician for follow-up diagnostic testing (e.g., laboratory testing) and/or conducting in-pharmacy point-of-care testing (PoCT) for a narrow range of selected measures⁴ and in-pharmacy noninvasive testing (e.g., spirometry, blood pressure monitoring).⁵

Currently, pharmaceutical care provision is heavily limited by the reliance on the referral of patients back to physicians for most laboratory tests. Such processes could be made more efficient if pharmacists had the ability to access and order those tests. The ability to *access* laboratory tests can be defined by one's authority to access and interpret patient laboratory data that have already been ordered. The ability to *order*, and subsequently access, laboratory data can be defined by one's authority to directly order laboratory tests for a patient. At present, most hospital or inpatient pharmacists around the world have the ability to access laboratory tests and use them to inform their clinical decisions. However, this is rarely the case for pharmacists who practise outside the hospital.⁶ Primary care pharmacists' full scope of practice should encompass prescribing, either within a collaborative practice agreement or via supplementary and independent models, as well as the ability to access and order laboratory tests.⁷⁻¹³

Primary care pharmacists' scope of practice depends on the jurisdiction they practise in. In addition to dispensing medications and providing medicine-related information to patients and health care providers, primary care pharmacists with relevant qualifications are also providing medication reviews, vaccination services, services for ambulatory conditions and integrating into primary health care teams.^{9,14-17} Further to these practices, prescriptive and laboratory testing authorities are within primary care pharmacists' scope, and many jurisdictions are moving towards utilizing this full scope of expertise. In Canada, this includes independent or collaborative prescriptive and/or laboratory testing authorities, depending on province/territory.¹⁵ In the United States, primary care pharmacists are involved in collaborative drug therapy management and disease state management, which may involve prescriptive and/or laboratory testing authorities, depending on state and agreement.¹⁶ In the United Kingdom, primary care pharmacists have prescriptive and laboratory testing authorities through supplementary or independent models.¹⁴ In New Zealand, primary care pharmacists within health care teams have independent prescriptive and laboratory testing authorities.⁹ Primary care pharmacists in Australia are not currently practising to their full scope of expertise with regards to prescriptive and laboratory testing authorities.¹⁷ The current literature

FIGURE 1 Review of the search strategy employed to find relevant literature

describes pharmacists' scope of practice in relation to prescribing medication and demonstrates the positive impact this has on patient outcomes and satisfaction.^{18,19} However, there are limited subsequent publications reporting on pharmacists' scope of practice in relation to laboratory testing. Therefore, the purpose of this review was to identify, describe and compare primary care pharmacists' current scope of practice in relation to accessing and ordering laboratory tests.

Methods

Search strategy

A 2-tiered search strategy was employed (Figure 1). Tier 1 comprised a search of the databases PubMed, EMBASE and MEDLINE. The following MeSH headings were used: *prescribing*, *pharmacist/pharmacy*, *laboratory test*, *collaborative practice* and *protocols/guidelines*, with the Boolean operator "AND" used to combine these

search terms. Tier 2 comprised a Google search to extract relevant grey literature using the same MeSH terms. This tier was employed to extract protocols, guidelines, descriptive articles and position statements. Manual screening of reference lists of relevant publications was performed to ensure literature not found in the original searches was also extracted. The search was restricted to the following: 1) published from January 2007 to April 2017 (to encapsulate the time period in which an expanded scope for pharmacists, including nonmedical prescribing, was the focus of discussion²⁰), 2) full text of the English language and 3) conducted in the United States, Canada, United Kingdom, New Zealand or Australia (to reflect the countries that were at the forefront of open debate for an expanded scope for pharmacists, including prescribing^{20,21}).

Study selection

All publications identified through the search strategy were evaluated for inclusion in the review. To meet the selection criteria for inclusion, the following had to be met: 1) intervention studies, qualitative studies (including surveys and questionnaires) or grey literature; 2) publications containing information on pharmacists' scope in relation to laboratory testing (i.e., any mention and/or description of pharmacists ordering and/or accessing laboratory tests as a component of the publication); and 3) central laboratory testing. Publications were excluded if they exclusively evaluated 1) PoCT, 2) training for pharmacists in laboratory testing and 3) inpatient hospital pharmacists.

Data extraction

Jurisdictions were categorized into the following based on the primary care pharmacists' authority to access and/or order laboratory tests:

- **Independently access and order laboratory tests:** Jurisdictions where pharmacists can order and access laboratory tests regardless of their prescribing status
- **Dependently access and order laboratory tests:** Jurisdictions where pharmacists can order and access laboratory tests as part of a collaborative practice agreement or similar
- **Independent prescribing pharmacists can access and order laboratory tests:**

Jurisdictions where only pharmacists with independent prescribing rights can order and access laboratory tests

- **Independent and supplementary prescribing pharmacists can access and order laboratory tests:** Jurisdictions where pharmacists with independent and/or supplementary prescribing rights can order and access laboratory tests
- **Independently access laboratory tests:** Jurisdictions where pharmacists only have authority to access laboratory tests
- **No access to laboratory testing:** Jurisdictions where pharmacists have no authority to access and/or order laboratory tests

Availability to patients

An estimate was calculated to crudely quantify the proportion of primary care pharmacists who can provide care that includes laboratory testing. The following equation was used to determine the proportion (%):

$$\frac{\text{calculated \# of primary care pharmacists with independent access to laboratory testing per 10,000 people}}{\text{calculated \# of primary care pharmacists per 10,000 people}} \times 100$$

Primary care pharmacists were defined as pharmacists practising in any setting except hospital inpatient, industry, academia or government agency. All primary care pharmacists within jurisdictions that grant independent authority to access and/or order laboratory testing were assumed to be using this authority. An estimate for the 5 countries reviewed was calculated.

Results

Our database search identified 3540 publications, of which 3512 were excluded because of irrelevance to objectives, 3 were exclusively evaluating PoCT or training and 5 were duplicates. Our grey literature search identified 13 publications for inclusion. Therefore, 33 publications were included in this review (Table 1). These publications were sourced from 4 countries. Most were from the United States (18) and Canada (12), with the remainder from the United Kingdom (2) and New Zealand (1) and none from Australia (0). The literature comprised quantitative (15) and qualitative (5) studies, as well as grey literature, such as practice guidelines, standards

TABLE 1 List of publications that were included in the review

Study and year	Literature type	Country	Findings in relation to laboratory testing
Al Hamarneh et al. (2016) ⁵⁰	RCT	Canada	Study states that pharmacists accessed and ordered laboratory tests, which were serum creatinine (and eGFR) and random urine albumin-to-creatinine ratio.
Alberta College of Pharmacists (2011) ²³	Guidelines	Canada	Guidelines for pharmacists ordering laboratory tests and using laboratory data in Alberta, Canada.
Anaya et al. (2008) ⁵⁹	Retrospective posttest evaluation	United States	Study states that pharmacists ordered all relevant laboratory tests and provides examples of laboratory tests ordered as well as the frequency (i.e., every 3 months for HbA 1c, annually for LDL).
Bourne et al. (2016) ³⁸	Questionnaire to describe the scope and future prospects of independent prescribers	United Kingdom	Study states that ~63% of independent prescribing pharmacists were performing therapeutic drug monitoring as part of their routine practice.
California Pharmacists Association (2014) ³²	Guidelines	United States	Guidelines for pharmacists ordering and managing tests to ensure safe and appropriate medication therapy in California.
Cooney et al. (2015) ⁵¹	RCT	United States	Laboratory tests ordered by pharmacists as per “guide to laboratory frequency and protocol for laboratory results” defined in study.
Farland et al. (2013) ⁶⁰	Prospective, multicentre, cohort study	United States	Study states that pharmacists ordered laboratory tests as part of their collaborative practice agreement. Described that pharmacists ordered HbA 1c, urine microalbumin-creatinine ratio tests or fasting lipid panel. However, does not describe frequency.
Hammond et al. (2003) ²⁹	Position statement	United States	Study states which states in the United States have authority to order laboratory tests within a collaborative practice agreement. However, does not describe what type of laboratory testing.
Hawes et al. (2016) ²⁸	Descriptive article	United States	Study states that pharmacists can order and interpret laboratory tests under physician supervision and specific protocols in North Carolina. However, does not describe the types of laboratory tests ordered/interpreted.
Heisler et al. (2014) ⁵²	Multisite, cluster randomized, controlled trial	United States	Study states that pharmacists can order laboratory tests in accordance with a provided treatment algorithm. However, does not describe the types of laboratory tests ordered.
Hill et al. (2016) ³⁷	Review	United States	Overview of relevant statutes, legislation and regulations on which jurisdictions can order laboratory tests within the 50 states of the United States.
Hirsch et al. (2014) ⁵³	Randomized, pragmatic clinical trial	United States	Study states that pharmacists ordered laboratory tests based on their clinical judgement, in consultation with a physician if required. The timing and reviewing of laboratory tests were the responsibility of the pharmacist. However, the study does not describe the types of laboratory tests ordered.

(continued)

TABLE 1 (continued)

Study and year	Literature type	Country	Findings in relation to laboratory testing
Holle et al. (2017) ³¹	Qualitative survey assessing pharmacists' activities in oral chemotherapy, MTM and CPA services	United States	Study states that pharmacists ordered and interpreted laboratory tests as part of their scope of practice in oral chemotherapy, MTM and CPA services. However, does not describe the types of laboratory tests ordered/interpreted.
Ip et al. (2013) ⁵⁴	Dual-centre, retrospective, control study	United States	States that pharmacists performed laboratory testing as part of their collaborative practice agreement. However, does not describe the types or frequency of laboratory testing.
Leung et al. (2016) ²⁷	Web-based survey to understand the current state of digital health use and benefits in community pharmacy practice	Canada	Survey stated that 22% of pharmacists have access to laboratory test results through a LIS in Canada, with 96% indicating they would like access. Overall, access to LIS improved productivity and quality of care.
MacLeod-Glover et al. (2011) ²⁴	Review	Canada	Explanatory policy analysis of government and regulatory documentation in Alberta, Canada. Provides an overview of which provinces in Canada have given pharmacists the authority to order and interpret laboratory tests. However, the review does not describe the types of laboratory testing.
Magid et al. (2013) ⁵⁵	Pragmatic RCT	United States	Study states that pharmacists ordered laboratory tests related to medication monitoring within a collaborative practice agreement. However, the study does not describe the types or frequency of the laboratory tests ordered. The authors, however, did attribute one of the successes of the study to the fact that pharmacists could order laboratory tests.
Mansell et al. (2017) ²⁵	Review	Canada	Overview of which provinces in Canada can access and order laboratory tests.
McBane et al. (2015) ³⁰	Position statement: Updated	United States	Study states which states in the United States have further authority, since 2003, to order laboratory tests within a collaborative practice agreement. However, does not describe the type of laboratory testing.
McKinnon and Jorgenson (2009) ⁵⁶	Prospective, nonrandomized controlled trial	Canada	Study states that pharmacists ordered laboratory tests related to medication monitoring within a collaborative agreement with a physician. However, the study does not describe the types or frequency of the laboratory tests ordered.
Murawski et al. (2011) ³⁴	Questionnaire to gather information on the practice environment of clinical pharmacist practitioners and pharmacist clinicians	United States	Study states that 12.5% of pharmacists could order laboratory tests as part of a collaborative practice agreement in North Carolina and New Mexico. However, the study does not describe the types or frequency of the laboratory tests ordered.

(continued)

TABLE 1 (continued)

Study and year	Literature type	Country	Findings in relation to laboratory testing
Nova Scotia College of Pharmacists (2015) ²²	Standards of Practice: Testing	Canada	Under the authority of the Regulations, the "Standards of Practice: Testing" establishes the expectations of pharmacists with respect to conducting, ordering, receiving and interpreting tests.
Olson et al. (2009) ⁶¹	RCT	United States	Study states that pharmacists ordered laboratory tests related to medication monitoring within a collaborative agreement with a physician. FLP was ordered every 8 to 12 weeks and after any changes to lipid-lowering medications or therapeutic lifestyle changes, until the patients achieved their LDL cholesterol goal. Once goal was achieved, FLP was ordered every 6 months until at least 2 consecutive LDL cholesterol values were at goal, at which time patients were monitored yearly. Laboratory data were entered into an electronic database to identify patients due for laboratory tests and minimize missed laboratory appointments.
Pharmaceutical Society of New Zealand Incorporated (2014) ⁹	Standards and Guidelines	New Zealand	Scope of practice for pharmacist prescribers, which states that a pharmacist prescriber can order and interpret investigations (including laboratory and related tests).
Pharmaceutical Society of Northern Ireland (2013) ³³	Standards and Guidelines	United Kingdom	Standards and guidelines about carrying out relevant diagnostic tests where appropriate in order to exclude contraindications, clarify doses or note treatment cautions.
Saskatchewan College of Pharmacy Professionals (2015) ²⁶	Standards and Guidelines	Canada	Policies, standards and guidelines for pharmacists in accessing, ordering, performing, using and interpreting medical laboratory tests.
Tallian et al. (2012) ³⁶	Survey to assess understanding and present the role, interventions and activities of the pharmacist	United States	Study states that pharmacists ordered routine drug therapy-related laboratory tests within a collaborative agreement with a physician in California. However, the study does not describe the types or frequency of the laboratory tests that were ordered.
Tsuyuki et al. (2015) ⁵⁷	Multicentre RCT	Canada	Study states that pharmacists monitored drug therapy changes. However, the study does not describe the types or frequency of the laboratory testing.
Tsuyuki et al. (2016) ⁵⁸	Multicentre RCT	Canada	Study states that pharmacists ordered laboratory tests as per their scope of practice. However, the study does not describe the types or frequency of the laboratory tests that were ordered.
Tsuyuki et al. (2016) ⁶³	RCT	Canada	Study states that whenever drug therapy was initiated or a dosage adjusted, the prescribing pharmacist ordered all appropriate laboratory tests (e.g., fasting lipid panel, apo-B, CK, ALT, creatinine, fasting blood sugars, A1c for diabetic patients). Participants were given a laboratory requisition to have follow-up fasting lipid panel, along with treatment-monitoring lab tests (e.g., ALT, CK), performed as needed and prior to each follow-up visit, with follow-up being in person or over the telephone at 6, 12, 18 and 24 weeks postrandomization.

(continued)

TABLE 1 (continued)

Study and year	Literature type	Country	Findings in relation to laboratory testing
Villeneuve et al. (2010) ⁶²	RCT	Canada	Study states that pharmacists ordered lipid panels and liver enzyme laboratory tests within a collaborative agreement with a physician. However, the study does not describe the frequency of the laboratory tests that were ordered.
Woolf et al. (2016) ³⁵	Descriptive article	United States	Overview of pharmacists' scope of practice within an integrated health system in Washington. The article states that the ordering of laboratory tests is the responsibility of the pharmacists, within their scope of practice, as defined by state laws and further detailed by internal protocols. However, it does not describe the types or frequency of the laboratory tests ordered.
Yu et al. (2013) ⁶⁴	Cohort study	United States	Study states that pharmacists ordered laboratory tests within a collaborative agreement with a physician in Northern California. However, the study does not explicitly describe the types or frequency of the laboratory tests that were ordered.

ALT, alanine aminotransferase; CK, creatinine kinase; CPA, collaborative practice agreement; eGFR, estimated glomerular filtration rate; FLP, fasting lipid profile; HbA1c, hemoglobin A1c; LDL, low-density lipoprotein; LIS, laboratory information system; MTM, medication therapy management; RCT, randomized controlled trial.

TABLE 2 Primary care pharmacists' ability to access laboratory tests

	Independently	Dependently
Canada		
Alberta	✓ ^a	
Quebec	✓ ^a	
Nova Scotia	✓ ^{ab}	
New Brunswick	✓ ^a	
Saskatchewan		✓ ^d
United States*		✓ ^d
United Kingdom	✓ ^c	✓ ^{de}
New Zealand	✓ ^c	
Australia		

*Except for Alabama, Delaware, New Hampshire, New York and Texas.

^aRegardless of prescribing status.

^bNot yet implemented.

^cAs an independent prescribing pharmacist.

^dAs defined in collaborative practice agreement or similar agreement.

^eAs a supplementary prescribing pharmacist.

and frameworks (6), descriptive articles/reviews (5) and position statements (2).

Ability to access laboratory tests

Primary care pharmacists' access to laboratory data varies depending on jurisdiction (Table 2).

Canada. Pharmacists in the provinces of Alberta, Quebec, Nova Scotia and New Brunswick in Canada have the authority to access laboratory data,²²⁻²⁵ although the standards for Nova Scotia do not specify how the relevant laboratory data are obtained by the pharmacist after they have been ordered, despite being required to forward the laboratory results to relevant health professionals if needed.²² In Saskatchewan, pharmacists can only access laboratory data that have been ordered within a collaborative practice agreement.²⁶ In Alberta, all pharmacists can access all laboratory data through a province-wide system called Netcare.²³ Leung et al.²⁷ surveyed Canadian community pharmacists to understand changes in digital health and the impact this had on practice. They reported that 23% of pharmacists have access to laboratory test results through a laboratory information system (LIS), with 57% of them experiencing an increase in productivity because of this access and 87% indicating better or much better quality of patient care.²⁷

United States. In the United States, pharmacists who participate in collaborative practice agreements in all states except Alabama, Delaware, New Hampshire, New York and Texas must have access to patients' laboratory data via medical records.²⁸⁻³¹ This could be access to the preferred documentation system or electronic health records, or it may mean that pharmacists have to overcome some obstacles to obtain this information.^{29,30} However, pharmacists in the United States may only access and interpret laboratory tests that have been defined by a collaborative practice agreement or a similar agreement.^{29,30,32}

United Kingdom. In the United Kingdom, pharmacists are able to access laboratory results if they are independent prescribers, whereas supplementary prescribers may only have access if it is defined in the pharmacist's agreement with the physician.³³

New Zealand. In New Zealand, only prescribing pharmacists have the authority to access laboratory test results.⁹

Australia. Australia currently has no published literature defining primary care pharmacists' access to laboratory data.

TABLE 3 Primary care pharmacists' ability to order laboratory tests

	Independently	Dependently
Canada		
Alberta	✓ ^{ab}	
Quebec	✓ ^a	
Nova Scotia	✓ ^{acd}	
Saskatchewan		✓ ^{bef}
United States*		✓ ^e
United Kingdom	✓ ^{gh}	✓ ^{ehi}
New Zealand	✓ ^{bg}	
Australia		

*Except for Alabama, Delaware, New Hampshire, New York and Texas.

^aRegardless of prescribing status.

^bVerbal or written consent from the patient is required.

^cAfter completing an educational program in laboratory testing.

^dNot yet implemented.

^eAs defined in collaborative practice agreement or similar agreement.

^fOnly a limited number of laboratory tests and must be performed under the direction of the Saskatchewan College of Pharmacy Professionals or within public health care institutions in accordance with their governing policies.

^gOnly where an established pharmacist-patient professional relationship is present and once it has been determined that the laboratory tests will not be duplicating tests previously ordered by another health care professional.

^hAs an independent prescribing pharmacist.

ⁱAs a supplementary prescribing pharmacist.

Ability to order laboratory tests

Ordering laboratory tests within primary care pharmacists' scope of practice varies between and within countries (Table 3).

Canada. The provinces of Alberta and Quebec authorize pharmacists to order any relevant laboratory tests irrespective of their prescribing status as per their current guidelines, protocols and standards.^{22,23,25} Nova Scotia pharmacists can order laboratory tests but are required to have completed an educational program in laboratory testing before they can do so (this program is not yet operational).^{22,25} In Saskatchewan, primary care pharmacists may only order a limited number of laboratory tests, which must be performed under the direction of the Saskatchewan College of Pharmacy Professionals or within public health care institutions in accordance with their governing policies.²⁶ Furthermore, the guidelines from Alberta and Saskatchewan indicate that pharmacists can only order laboratory tests for patients where an established pharmacist-patient professional relationship is present and once it has

been ascertained that they will not be duplicating any laboratory test previously ordered by another health care professional.^{23,26}

United States. At present, the majority of states in the United States, except Alabama, Delaware, New Hampshire, New York and Texas, have given primary care pharmacists the authority to order laboratory tests within a collaborative practice agreement with a physician.^{28-31,34-37} This agreement may include 1 or all of the following responsibilities of ordering, managing, accessing and/or interpreting laboratory tests and is dependent on state laws and internal protocols.³⁷ However, California is the only state that has published guidelines for their pharmacists. Such guidelines indicate that pharmacists can only order laboratory tests for patients under their care and once they have ascertained that laboratory tests are not duplicates.³²

United Kingdom. Pharmacists can order laboratory tests if they are either an independent or supplementary prescribing pharmacist.

FIGURE 2 Comparison of primary care pharmacists' scope of practice in relation to laboratory testing

However, the extent of the supplementary prescribing pharmacists' scope of practice is determined by an independent prescriber (e.g., physician or dentist) and defined by an agreed-upon patient-specific clinical management plan in consultation with the patient.³³ For both independent and supplementary prescribing pharmacists, the standards and guidelines have specified that they require verbal or written consent from the patient to order laboratory tests for the purpose of excluding contraindications, clarifying doses or noting treatment cautions.³³ Bourne et al.³⁸ surveyed UK independent prescribing critical care pharmacists to determine their current and proposed future scope of practice in this setting. The authors found that therapeutic drug monitoring was routine practice among this sample of pharmacists.

New Zealand. In New Zealand, the prescribing pharmacists framework indicates that they have the authority to order and interpret laboratory tests within a collaborative health team environment, although there is a lack of literature describing the extent of this practice.⁹

Australia. Australia currently has no published literature defining primary care pharmacists' authority to order laboratory tests.

Availability to patients

Figure 2 provides a comparison of primary care pharmacists' scope of practice in relation to laboratory testing within the 5 reviewed countries. Among these countries, we estimated that 35%, 0%, 4%, 0.3% and 0% of primary care pharmacists in Canada, the United States, the United Kingdom, New Zealand and Australia, respectively, are able to provide care that includes independent laboratory testing (Figure 3).³⁹⁻⁴⁹

Interventional and qualitative studies

There are limited interventional and qualitative studies evaluating and describing pharmacists' scope of practice in relation to ordering laboratory tests. One study, conducted in Canada by Al Hamarneh et al.⁵⁰ in 2016, found that when pharmacists' scope of practice included laboratory testing, previously unrecognized chronic kidney disease was uncovered in 40% of high-risk patients. This highlights the potential of ordering laboratory testing to positively affect

FIGURE 3 Proportion of primary care pharmacists* who can provide care that includes independent laboratory testing

patient care and outcomes. However, the other interventional and qualitative studies included in this review only mentioned that pharmacists were ordering and interpreting laboratory data and did not explicitly evaluate the benefits of this for patients, pharmacists, other health care professionals and/or the health care system.⁵¹⁻⁶³

In the few studies that do describe the scope of practice, the extent of the description is only of the types and frequency of tests ordered. The types of laboratory tests being ordered include hemoglobin A1c (HbA1c),^{52,59,63} low-density lipoprotein (LDL),^{52,59} urine microalbumin-creatinine ratio,^{51,60} estimated glomerular filtration rate (eGFR), parathyroid hormone (PTH), phosphorus and proteinuria,⁵¹ fasting lipid profile,^{60,61,63} apo-B, creatinine kinase, alanine aminotransferase (ALT), serum creatinine, fasting blood sugars,⁶³ lipid panels and liver enzymes.⁶²

Improvements in patient outcomes

Currently, there is a lack of interventional and qualitative studies explicitly evaluating whether

using primary care pharmacists' full scope of practice (including laboratory testing) improves patient outcomes, with all studies included in this review being conducted in either Canada or the United States. Nonetheless, the majority of studies that mentioned pharmacists accessing and ordering laboratory data, in some capacity, resulted in positive patient outcomes (Table 4).

Canada. The majority of literature from Canada, which involved pharmacists independently accessing and ordering laboratory tests, showed positive patient outcomes, which ranged from reducing the risk of cardiovascular disease (CVD) events, uncovering unrecognized chronic kidney disease (CKD), reducing blood pressure (BP) and achieving target lipid levels.^{50,57,58,63} McKinnon and Jorgenson⁵⁶ showed positive patient outcomes through an improvement in patient medication management when the pharmacists accessed and ordered laboratory tests dependently, as well.⁵⁶ On the other hand, Villeneuve et al.⁶² reported no significant

TABLE 4 Improvements in patient outcomes when primary care pharmacists' scope of practice includes laboratory testing

	Independently ^a	Dependently ^b
Improvements		
Reduced risk of CVD events	✓	
Reduction in long-term CVD risk		✓
Uncovered unrecognized CKD	✓	
Reduction in blood pressure	✓	✓
Lipid control	✓	
Glycemic control		✓
Patient medication management		✓
Patient satisfaction		✓
No significant improvements		
Lipid control	✓	✓
Reduction in blood pressure		✓
Glycemic control		✓

CKD, chronic kidney disease; CVD, cardiovascular disease.

^aPharmacists independently accessed and ordered laboratory tests.

^bPharmacists dependently accessed and order laboratory tests.

difference in lipid control when compared to usual care without physician-pharmacist collaboration, when pharmacists could access and order laboratory data independently.⁶²

United States. In the United States, all primary care pharmacists accessed and ordered laboratory data dependently within a collaborative practice agreement. The majority of these studies found positive patient outcomes, including improvement in glycemic control and diabetes-related health maintenance, a reduction in BP, a reduction in long-term CVD risk and an improvement in patient satisfaction.^{53-55,59,60,64} However, Heisler et al.⁵² reported short-term improvements in lowering BP but no difference in BP, HbA1c and LDL levels between intervention and control in the long run when they evaluated a targeted pharmacist-led management program to improve BP, which included the ordering of HbA1c and LDL laboratory tests for patients with diabetes and persistent hypertension.⁵² Furthermore, a study by Cooney et al.⁵¹ evaluated the effect of a pharmacist-based quality improvement program on CKD patient outcomes and adherence to

CKD guidelines, which involved the ordering of eGFR, proteinuria, PTH, phosphorus and urine microalbumin-creatinine ratio laboratory tests to improve BP. This study showed no significant improvements in BP but did find an overall improvement in adherence to guidelines.⁵¹

Discussion

Patients around the world deserve to receive a full scope of pharmacist services—this includes prescribing, disease management, injections and laboratory testing.¹³ To our knowledge, this is the first review to explore primary care pharmacists' scope of practice in relation to laboratory testing. Primary care pharmacists' full scope of practice is not being fully used in most jurisdictions when it comes to laboratory testing, and when it is used, it is often in a dependent fashion. Overall, the limited literature indicates that certain jurisdictions of Canada have defined guidelines allowing pharmacists to access and order laboratory tests in primary care settings such as community pharmacies, within primary care teams in health centres or as part of a collaborative practice agreement with a physician.^{22,23,26,56-58,62,63} In comparison, clinical

pharmacists in the United States who practise in multidisciplinary primary care clinics are able to order and interpret laboratory tests in a dependent fashion.^{28,31,32,34-36,51-55,59-61} Pharmacists in the United Kingdom are required to perform laboratory testing as part of their independent or supplementary prescribing roles, with independent prescribing pharmacists predominantly doing so in the critical care setting.^{33,38} In New Zealand, prescribing pharmacists order and interpret laboratory tests within collaborative health teams.⁹ At present, Australia has no published literature defining primary care pharmacists' scope of practice in laboratory testing. Such services have the potential to improve patient outcomes by facilitating prescribing and potentially reducing medication-related errors, but it seems to be limited to only a few jurisdictions and often only in a dependent fashion.

Pharmacists' scope of practice in relation to prescribing medications, as well as the positive impact this has on patient outcomes and satisfaction, has been previously described and evaluated.^{28,51-61,63} Despite a shift towards full utilization of pharmacists' scope with the inclusion of prescribing, access to laboratory testing has not yet been widely incorporated, and so there is a gap that limits the evaluation and description of pharmacists' scope of practice. This is evident by the established prescribing frameworks, standards and/or guidelines for pharmacists in the United States, Canada, the United Kingdom and New Zealand.^{9,29,30,33,65,66} In contrast, there are limited subsequent frameworks, standards and/or guidelines for pharmacists specific to laboratory testing across and within these countries. This review has highlighted not only the need for the adoption of coherent policies for pharmacists who participate in laboratory testing but also the importance of laboratory testing for patients to receive a full scope of pharmacists' services. A full scope of practice promotes patient-centred care via collaborative practice with other health care professionals when implemented. Furthermore, improved patient outcomes and economic benefits with a full scope of practice for pharmacists have previously been described and evaluated.^{28,51-61,63,67}

The current scope of practice markedly limits patients' access to primary care pharmacists who can provide laboratory testing services. We estimated that 2.93, 0, 0.24, 0.02 and 0 primary care pharmacists per 10,000 Canadians,

Americans, British, New Zealanders and Australians, respectively, can provide care that includes independent laboratory testing.³⁹⁻⁴⁹ Practically speaking, this means that in the countries reviewed, only 0% to 35% of primary care pharmacists can provide care that includes laboratory testing. Due to this limited scope of practice in laboratory testing, as well as the paucity of literature, it is difficult to ascertain the true extent of primary care pharmacists' current scope of practice. A lack of published interventional studies meant that several questionnaire and survey studies were included in this review. Furthermore, this review follows a systematic method. It encompasses some elements of a systematic review, such as predefined inclusion and exclusion criteria and a comprehensive search of select databases. However, it does not critically analyze the quality of the literature and includes grey literature. A meta-analysis, applying the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, was unable to be performed due to the nature of this review, specifically a lack of substantial publications, with the majority being grey literature. Moreover, this review included a grey literature search, which may not have returned all the relevant publications. It also focused on 5 countries (Canada, United States, United Kingdom, New Zealand and Australia) and did not include publications prior to 2007. Therefore, critical publications with the potential to reveal important insights may not have been captured in the search. Future reviews could focus on expanding these criteria. These limitations must be considered when interpreting the findings of this review.

Practice implications

Primary care pharmacists' involvement in laboratory testing has the potential to improve patient outcomes. This review has identified that only a few jurisdictions in the United States, Canada, the United Kingdom and New Zealand have authorized their primary care pharmacists to access and perform laboratory testing, which is patient centred and promotes collaborative practices. As such, there is a need for pharmacists to pursue laboratory testing in order to be able to provide a full scope of practice for their patients. There is also a need for standards, guidelines and frameworks to support those jurisdictions that are lacking in these policies

and for future research focusing on evaluating related outcomes.

Conclusion

Primary care pharmacists' scope of practice in relation to laboratory testing is presently limited to certain jurisdictions and often occurs only in a dependent fashion. As such, a full scope of pharmacy services is almost entirely unavailable

to patients in the United States, the United Kingdom, New Zealand and Australia. Just as in the case for pharmacist prescribing, evidence indicates better patient outcomes when pharmacists can access/order laboratory tests, but more research needs to be done alongside the implementation of local guidelines and practice standards for primary care pharmacists who are participating in laboratory testing. ■

From the Graduate School of Health (Pharmacy) (Donovan, Bajorek), The University of Technology Sydney, Broadway, NSW, Australia; and the Faculty of Medicine and Dentistry (Tsuyuki, Al Hamarneh), University of Alberta and EPICORE Centre (Tsuyuki, Al Hamarneh), Edmonton, Alberta. Contact jacqueline.n.donovan@student.uts.edu.au.

Author Contributions: J. Donovan conducted the literature search, screened titles and abstracts, reviewed articles, extracted data, wrote the initial full draft of the manuscript and edited the manuscript. B. Bajorek developed themes and reviewed and edited the manuscript. R. Tsuyuki and Y. Al Hamarneh developed the initial research question and developed themes and reviewed and edited the manuscript. All authors approved the final version of the manuscript.

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

Funding: This review received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. This review has not been sponsored by industry.

ORCID iDs: Jacqueline Donovan <https://orcid.org/0000-0003-1774-1625>

Yazid N. Al Hamarneh <https://orcid.org/0000-0003-3984-3542>

References

1. Tsuyuki RT, Beahm NP, Okada H, et al. Pharmacists as accessible primary health care providers: review of the evidence. *Can Pharm J (Ott)* 2018;151(1):4-5.
2. Al Hamarneh YN, Lamb S, Donald M, et al. Pharmacist prescribing and care improves cardiovascular risk, but what do patients think? A substudy of the Rx EACH study. *Can Pharm J (Ott)* 2018;151(4):223-7.
3. World Health Organization. *The role of the pharmacist in the health care system*. New Delhi (India): World Health Organization; 1994.
4. Kehrer JP, James DE. The role of pharmacists and pharmacy education in point-of-care testing. *Am J Pharm Educ* 2016;80(8):129.
5. Howarth H, Jackson S, Fitzmaurice K, et al. *Report of health promotion and screening activities by community pharmacists*. Hobart, Tasmania: Community Pharmacy Research Support Centre: A Collaboration of Australian Pharmacy Schools; 2005.
6. World Health Organization. *The role of the pharmacist in the health care system: the scope of pharmacy and the functions of pharmacists: hospital pharmacy*. New Delhi (India): WHO Consultative Group; 1994.
7. Emmerton L, Marriott J, Bessell T, et al. Pharmacists and prescribing rights: review of international developments. *J Pharm Pharm Sci* 2005;8(2):217-2.
8. Herrier RN, Boyce RW, Apgar DA. Pharmacist-managed patient-care services and prescriptive authority in the U.S. Public Health Service. *Hosp Formul* 1990;25(1):67-8, 76-8, 80.
9. Pharmaceutical Society of New Zealand Incorporated. *New Zealand National Pharmacist Services Framework*. Wellington: Pharmaceutical Society of New Zealand Incorporated; 2014.
10. Pearson GJ. Evolution in the practice of pharmacy—not a revolution! *CMAJ* 2007;176(9):1295-6.
11. Tonna AP, Stewart D, West B, et al. Pharmacist prescribing in the UK: a literature review of current practice and research. *J Clin Pharm Ther* 2007;32(6):545-5.
12. Yuksel N, Eberhart G, Bungard TJ. Prescribing by pharmacists in Alberta. *Am J Health Syst Pharm* 2008;65(22):2126-32.
13. Tsuyuki RT, Houle SKD, Okada H. Time to give up on expanded scope of practice [Editorial]. *Can Pharm J (Ott)* 2018;151(5):286-7.
14. Murray R. Community pharmacy clinical services review. Leeds, England: NHS England; 2016, p. 31. Available: <https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2016/12/community-pharm-clncl-serv-rev.pdf>
15. The Conference Board of Canada. *A review of pharmacy services in Canada and the health and economic evidence*. Ottawa: Canadian Pharmacists Association; 2016.
16. Scott DM. United States health care system: a pharmacy perspective. *Can J Hosp Pharm* 2016;69(4):306-1.
17. Moles RJ, Stehlik P. Pharmacy Practice in Australia. *Can J Hosp Pharm* 2015;68(5):418-2.

18. Weeks G, George J, Maclure K, et al. Non-medical prescribing versus medical prescribing for acute and chronic disease management in primary and secondary care. *Cochrane Database Syst Rev* 2016;11:CD011227.
19. Buss VH, Deeks LS, Shield A, et al. Analytical quality and effectiveness of point-of-care testing in community pharmacies: a systematic literature review. *Res Social Adm Pharm* 2019;15(5):483–9.
20. Koehler T, Brown A. Documenting the evolution of the relationship between the pharmacy support workforce and pharmacists to support patient care. *Res Social Adm Pharm* 2017;13(2):280–5.
21. Cope LC, Abuzour AS, Tully MP. Nonmedical prescribing: where are we now? *Ther Adv Drug Saf* 2016;7(4):165–7.
22. Nova Scotia College of Pharmacists. *Standards of practice: testing*. Halifax: Nova Scotia College of Pharmacists; 2015.
23. Alberta College of Pharmacists. *Guidelines for pharmacists ordering laboratory tests and using laboratory data*. Edmonton: Alberta College of Pharmacists; 2011.
24. MacLeod-Glover N. An explanatory policy analysis of legislative change permitting pharmacists in Alberta, Canada, to prescribe. *Int J Pharm Pract* 2011;19(1):70–8.
25. Mansell K, Edmunds K, Guirguis L. Pharmacists' scope of practice: supports for Canadians with diabetes. *Can J Diabetes* 2017;41(6):558–6.
26. Saskatchewan College of Pharmacy Professionals. *Policies, standards and guidelines for pharmacists in accessing, ordering, performing using or interpreting medical laboratory tests*. Regina, Saskatchewan: Saskatchewan College of Pharmacy Professionals; 2015.
27. Leung V, Tharmalingam S, Cooper J, et al. Canadian community pharmacists' use of digital health technologies in practice. *Can Pharm J (Ott)* 2016;149(1):38–45.
28. Hawes EM, Misita C, Burkhart JL, et al. Prescribing pharmacists in the ambulatory care setting: experience at the University of North Carolina Medical Center. *Am J Health Syst Pharm* 2016;73(18):1425–33.
29. Hammond RW, Schwartz AH, Campbell MJ, et al. Collaborative drug therapy management by pharmacists—2003. *Pharmacotherapy* 2003;23(9):1210–25.
30. McBane SE, Dopp AL, Abe A, et al. Collaborative drug therapy management and comprehensive medication management—2015. *Pharmacotherapy* 2015;35(4):e39–50.
31. Holle LM, Harris CS, Chan A, et al. Pharmacists' roles in oncology pharmacy services: results of a global survey. *J Oncol Pharm Pract* 2017;23(3):185–9.
32. California Pharmacists Association. *Guidelines for Pharmacists ordering and managing tests to ensure safe and appropriate medication therapy*. 5th ed. Sacramento, CA: California Pharmacists Association; 2014.
33. Pharmaceutical Society of Northern Ireland. *Standards and guidance for pharmacist prescribers*. Belfast, Northern Ireland: Pharmaceutical Society of Northern Ireland; 2013.
34. Murawski M, Villa KR, Dole EJ, et al. Advanced-practice pharmacists: practice characteristics and reimbursement of pharmacists certified for collaborative clinical practice in New Mexico and North Carolina. *Am J Health Syst Pharm* 2011;68(24):2341–50.
35. Woolf R, Locke A, Potts C. Pharmacist prescribing within an integrated health system in Washington. *Am J Health Syst Pharm* 2016;73(18):1416–624.
36. Tallian KB, Hirsch JD, Kuo GM, et al. Development of a pharmacist-psychiatrist collaborative medication therapy management clinic. *J Am Pharm Assoc* (2003) 2012;52(6):e252–8.
37. Hill JD, Hill JM, Gentile NJ. A review of state pharmacist collaborative practice laws. *Am J Health Syst Pharm* 2016;73(18):1467–72.
38. Bourne RS, Whiting P, Brown LS, et al. Pharmacist independent prescribing in critical care: results of a national questionnaire to establish the 2014 UK position. *Int J Pharm Pract* 2016;24(2):104–1.
39. National Association of Pharmacy Regulatory Authorities (NAPRA). *National statistics: provincial and territorial statistics—pharmacists: National Association of Pharmacy Regulatory Authorities (NAPRA)*. 2019. Available: <https://napra.ca/national-statistics> (accessed June 20, 2019).
40. Canadian Institute for Health Information (CIHI). *Health workforce, 2018—data tables*. Ottawa, ON: CIHI; 2018.
41. Bureau of Labor Statistics. *Occupational outlook handbook (pharmacists)*. Washington (DC): Office of Occupational Statistics and Employment Projections, US Department of Labor; 2019. Available: https://www.bls.gov/ooh/healthcare/pharmacists.htm?view_full#tab-3 (accessed June 20, 2019).
42. Gaither CA, Schommer JC, Doucette WR, et al. *2014 National Pharmacist Workforce Survey*. Minneapolis (MN): Pharmacy Workforce Center, Inc. (PWC); 2015.
43. General Pharmaceutical Council (GPhC). *Annual report: annual fitness to practice report and annual accounts 2015/16*. London (UK): GPhC; 2016.
44. General Pharmaceutical Council (GPhC). *Registrant survey 2013: initial analysis*. London (UK): GPhC; 2014.
45. General Pharmaceutical Council (GPhC). *Prescribers survey report*. London (UK): GPhC; 2016.
46. Pharmacy Council New Zealand. *2018 Workforce demographic report*. Wellington: Pharmacy Council New Zealand; 2018.
47. Raghunandan R, Tordoff J, Smith A. Non-medical prescribing in New Zealand: an overview of prescribing rights, service delivery models and training. *Ther Adv Drug Saf* 2017;8(11):349–6.
48. Australian Health Practitioner Regulation Agency (AHPRA). *2017/18 Pharmacy Board of Australia—annual report summary*. Melbourne: AHPRA; 2018.
49. Health Workforce Australia. *Australia's health workforce series pharmacists in focus*. Adelaide: Health Workforce Australia; 2014.
50. Al Hamarneh YN, Hemmelgarn B, Curtis C, et al. Community pharmacist targeted screening for chronic kidney disease. *Can Pharm J (Ott)* 2016;149(1):13–7.
51. Cooney D, Moon H, Liu Y, et al. A pharmacist based intervention to improve the care of patients with CKD: a pragmatic, randomized, controlled trial. *BMC Nephrol* 2015;16:56.

52. Heisler M, Hofer TP, Schmittiel JA, et al. Improving blood pressure control through a clinical pharmacist outreach program in patients with diabetes mellitus in 2 high-performing health systems: the adherence and intensification of medications cluster randomized, controlled pragmatic trial. *Circulation* 2012;125(23):2863-72.
53. Hirsch JD, Steers N, Adler DS, et al. Primary care-based, pharmacist-physician collaborative medication-therapy management of hypertension: a randomized, pragmatic trial. *Clin Ther* 2014;36(9):1244-54.
54. Ip EJ, Shah BM, Yu J, et al. Enhancing diabetes care by adding a pharmacist to the primary care team. *Am J Health Syst Pharm* 2013;70(10):877-8.
55. Magid DJ, Olson KL, Billups SJ, et al. A pharmacist-led, American Heart Association Heart360 Web-enabled home blood pressure monitoring program. *Circ Cardiovasc Qual Outcomes* 2013;6(2):157-6.
56. McKinnon A, Jorgenson D. Pharmacist and physician collaborative prescribing: for medication renewals within a primary health centre. *Can Fam Physician* 2009;55(12):e86-91.
57. Tsuyuki RT, Houle SK, Charrois TL, et al. Randomized trial of the effect of pharmacist prescribing on improving blood pressure in the community: the Alberta Clinical Trial in Optimizing Hypertension (RxACTION). *Circulation* 2015;132(2):93-100.
58. Tsuyuki RT, Al Hamarneh YN, Jones CA, et al. The effectiveness of pharmacist interventions on cardiovascular risk: the multicenter randomized controlled Rx EACH trial. *J Am Coll Cardiol* 2016;67(24):2846-54.
59. Anaya JP, Rivera JO, Lawson K, et al. Evaluation of pharmacist-managed diabetes mellitus under a collaborative drug therapy agreement. *Am J Health Syst Pharm* 2008;65(19):1841-5.
60. Farland MZ, Byrd DC, McFarland MS, et al. Pharmacist-physician collaboration for diabetes care: the diabetes initiative program. *Ann Pharmacother* 2013;47(6):781-9.
61. Olson KL, Delate T, Rasmussen J, et al. Outcomes of patients discharged from pharmacy-managed cardiovascular disease management. *Am J Manag Care* 2009;15(8):497-503.
62. Villeneuve J, Genest J, Blais L, et al. A cluster randomized controlled Trial to Evaluate an Ambulatory primary care Management program for patients with dyslipidemia: the TEAM study. *CMAJ* 2010;182(5):447-5.
63. Tsuyuki RT, Rosenthal M, Pearson GJ. A randomized trial of a community-based approach to dyslipidemia management: pharmacist prescribing to achieve cholesterol targets (RxACT Study). *Can Pharm J (Ott)* 2016;149(5):283-9.
64. Yu J, Shah BM, Ip EJ, et al. A Markov model of the cost-effectiveness of pharmacist care for diabetes in prevention of cardiovascular diseases: evidence from Kaiser Permanente Northern California. *J Manag Care Pharm* 2013;19(2):102-1.
65. Royal Pharmaceutical Society of Great Britain. *Clinical governance framework for pharmacist prescribers and organisations commissioning or participating in pharmacist prescribing (GB wide)*. London, UK: Royal Pharmaceutical Society of Great Britain; 2007.
66. National Association of Pharmacy Regulatory Authorities (NAPRA). *Model standards of practice for Canadian pharmacists*. Ottawa, ON: NAPRA; 2009.
67. Franklin BE, Farland MZ, Thomas J, et al. Pharmacoeconomic analysis of the diabetes initiative program: a pharmacist-physician collaborative care model. *Ann Pharmacother* 2013;47(12):1627-34.