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Exploring the Responses of Prescribing Pharmacists and Family Physicians to Common Cases of Ambulatory Conditions

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Exploring the Responses of Prescribing
Pharmacists and Family Physicians to Common Cases of Ambulatory Conditions
by

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A THESIS

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Abstract

Changes in the scope of practice of pharmacists have granted prescribing privileges to pharmacists in various jurisdictions. While seen as a natural progression of the expertise of pharmacy professionals by some, prescribing pharmacists have also been met with a range of cautionary warnings regarding proficiency and appropriateness because of the traditional training of pharmacists. Different models of prescribing pharmacist continue to be considered and implemented particularly regarding the treatment of ambulatory conditions, sometimes referred to as minor illness or ailments. Studies seeking to characterize the parameters of prescribing pharmacists with respect to ambulatory conditions such as clinical reasoning and clinical decision-making have been limited to using qualitative measures as well as focusing on a single prototypical clinical case.

The following thesis describes a study which an online survey of multiple clinical cases of common ambulatory conditions was used to quantitatively assess the performance and behaviors of prescribing pharmacists in Alberta, Canada using family physicians as a comparison group. Participants were asked to respond to the clinical cases with diagnostic and therapeutic selections as well as report confidence in both selections. The prescribing pharmacists were hypothesized to demonstrate lower performance and confidence in selections compared to family physician counterparts due to aforementioned differences in training.

The findings of the study concluded that there were no significant differences in the diagnostic and therapeutic selection scores or in the reported confidence levels between a sample of prescribing pharmacists and family physicians. This research provides some of the first baseline evidence demonstrating the capabilities of prescribing pharmacists in the assessment and treatment of a range of ambulatory conditions. Future studies building on these findings should

seek to understand how prescribing pharmacists can be better integrated into the healthcare system, particularly by using the methods of this study as a framework for the assessment of pharmacist in training and in practice.

Preface

This thesis is original, unpublished, independent work by the author Vincent Chiang. Chapter 4 represents a manuscript written in preparation for submission to the *Journal of Social and Administrative Pharmacy*. The research conducted, largely the manuscript completed as chapter 4, were covered by the Ethics Certificate Number REB20-1770, issued by the University of Calgary Conjoint Health Ethics Board for the project titled “Exploring diagnostic and prescribing decision-making” issued on December 7, 2020.

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Dedication

This thesis is dedicated to all healthcare providers who were lost in the COVID-19 pandemic. It didn't have to end up like this nor should it continue.

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List of Symbols, Abbreviations, and Nomenclature

Abbreviation	Definition
ACP	Alberta College of Pharmacy
APA	Additional Prescribing Authority
ALM	Amy Louise Warren
BSc Pharm	Bachelor of Science in Pharmacy
CPhA	Canadian Pharmacist's Association
CPSA	College of Physicians and Surgeons of Alberta
DT	David Topps
KH	Kent Hecker
LG	Lisa Guirguis
MD	Doctor of Medicine
PharmD	Doctor of Pharmacy
OTC	Over-the-counter [medicine]
SJA	Sarah Jayne Anderson
VC	Vincent Chiang

Chapter One: Introduction

1.1 Overview

Drug prescribing is the process by which authorized healthcare providers select and formally communicate the use of medications for patient care. Pharmacists typically act as the mediators between prescribers and patients, ensuring accurate and appropriate dispensing of drug products. Within the last 20 years, pharmacist roles have expanded, chief among the changes has been the capability to prescribe medications. Initially pioneered in the United States (U.S.) (1), pharmacist prescribing now exists globally, with prime examples in the United Kingdom (U.K.), Poland, New Zealand, and Canada (1-5). The expanded scope of practice was intended to enhance the care provided by pharmacists to address shortcomings in current healthcare systems. However, pharmacist prescribing has been met with concerns, particularly around a greater potential for misdiagnosis and mistreatment, from various stakeholders including pharmacists, physicians, and patients (6, 7). The concerns primarily stem from the traditional training of pharmacists being seen as not conducive to teaching pharmacists the clinical decision making necessary to facilitate appropriate prescribing, while studies of pharmacist decision making have demonstrated mixed results (8). Despite the concerns, various models of prescribing pharmacists have been implemented across the world such as the U.K., the United States, and Canada, most prominently in the province of Alberta (9-11). Other jurisdictions such as the provinces of British Columbia and Ontario in Canada as well as countries like Australia are considering implementing prescribing pharmacists' models (12, 13). As such, research regarding the performance, efficacy and capabilities of prescribing pharmacists is needed to assist with understanding baseline prescribing abilities and if, and where, there could be ways of adjusting education to better prepare pharmacists for this role. This study is a preliminary investigation in understanding the

behaviours and processes that a prescribing pharmacist would utilize to make clinical decisions when presented with common ambulatory cases.

1.2 Study rationale and purpose

The objective of this exploratory study was to compare diagnostic and therapeutic selection performance between pharmacists and family physicians. Common ambulatory conditions, also known as minor illnesses, in the outpatient/ community setting which would present to both health care professionals were chosen as the clinical framework for this study. The clinical scenarios used were identified by a panel of pharmacy and family medicine experts based in the outpatient community setting. Once the clinical scenarios were selected, developed, and piloted, pharmacists and family physicians were asked to review and respond to a series of common clinical scenarios with diagnostic and therapeutic choices as well as to report confidence in the choices made. Results were compiled to determine whether there were any within or between group differences in diagnostic and therapeutic choices to these common clinical presentations.

This purpose of this study was to assess the current state of pharmacist competency in prescribing by providing baseline evidence regarding the similarities and/or differences in performance between pharmacist and family physicians to common ambulatory cases. Given previous literature demonstrating knowledge differences between pharmacists and physicians (14, 15), we hypothesized that pharmacists would demonstrate significantly lower proficiency in diagnostic and therapeutic selection for ambulatory conditions compared to family physicians.

Findings from this study could potentially inform future research as well as educational and policy recommendations regarding how to best train and utilize prescribing pharmacists. This work provides foundational information regarding how prescribing patterns are similar or

different between the two groups, as well as an exemplar on how to determine what common cases that these two groups prescribe for, which can inform future prescribing pharmacist policies. The results can potentially provide a mechanism for assessing readiness or competency in prescribing in ambulatory cases for entry into practice, continuing education, or remediation. Lastly, this study potentially determines ways of assessing prescribing competencies in pharmacists and physicians as to better optimize the health system for all patients. By understanding the spectrum of services that each group can effectively provide, resources can be better allocated to increase the efficiency of scarce healthcare systems.

1.3 Thesis organization

This thesis is organized into five chapters. Chapter One here introduces the topic of the thesis and provides a broad overview of the research projects rationale, purpose, and methods. Chapter Two is a literature review into the background of pharmacy practice, the transitions regarding expanded scope of practice and the related concerns. Chapter Three explores clinical reasoning and clinical decision-making terminology relevant to this thesis as well as related research conducted in the field of pharmacy. Chapter Four represents a manuscript authored by VC representing the original research conducted as part of thesis. Finally, Chapter Five presents a discussion of study findings including implications and suggestions for future research.

Chapter Two: Background in Pharmacy Practice

Chapter 2.1: Evolution of Pharmacy Practice

In this chapter, I describe background knowledge regarding the field of pharmacy that motivates the upcoming work in this thesis. The purpose of this chapter is to illustrate the role that pharmacists currently play in the context of the Canadian healthcare system as well as the criticisms regarding their role as prescribers that this thesis will attempt to address.

Pharmacists are healthcare professionals trained to be experts in medication and other aspects of drug therapy. In the current Canadian healthcare system, pharmacists are involved in the dispensing of medications prescribed by other healthcare professionals namely physicians, dentists, nurse practitioners etc. Dispensing involves the act of evaluating prescriptions and patient information, i.e. ensuring the “five rights” of medication use: the right patient, the right drug, the right times, the right dose, and the right route (16). Other traditional roles of the pharmacist include medication compounding and educating patients regarding medication use.

Within the last 20 years, pharmacy practice has been undergoing transitions to meet the changing needs of patients and the healthcare system (17, 18). In Canada, pharmacists have taken more active roles in patient care beyond purely validating prescription accuracy. In line with the more clinical roles, the scope of practice for pharmacists have changed to allow pharmacists to provide clinically oriented services (18). The Canadian Pharmacists Association have identified 4 authorities to define the expanded scope of practice in Canada: the authority to dispense medications; the authority to administer medications; the authority to order, receive, conduct, and interpret health tests; and the authority to prescribe medications (10). Of the four

authorities, the authority to prescribe medications represents the largest change in pharmacist roles.

Chapter 2.2: Models of pharmacist prescribing

Prescriptions are the formal documentation of the advice and authorization of a healthcare professional regarding the use of therapies, especially drug therapy (19).

Traditionally, pharmacists act as dispensers that received and translated medication prescriptions into actual patient care. However, as pharmacy practice expands, pharmacists can now engage in a range of prescriptive activities and multiple models of pharmacist prescribing have been identified (20, 21). These activities range in terms of the autonomy exercised by the pharmacist, from dependant to independent. Dependent prescribing occurs when a pharmacist enters a voluntary partnership with other prescribers to supplement the care or prescribing provided by the other prescribers to patients. The prescriptions are provided under the auspice of both providers' authorities and the types of medications that can be prescribed are limited by the agreement made between the pharmacist and other prescriber. Independent prescribing occurs without the pharmacist needing to be in any formal relationship with other prescribers but are typically limited by legislation and the pharmacist's personal competency. As Nissen notes, independent is used in this context to refer to the degree of responsibility taken on by the pharmacist during a prescriptive activity. While independent prescribing by pharmacists is performed without the need of other prescribers' authorities, pharmacists are encouraged to act in an interdisciplinary manner, just like all healthcare providers. For instance, pharmacists are often mandated to contact other prescribers regarding prescription changes and initiation as well as consult or refer patients to more appropriate providers when deemed necessary.

Examples of both supplementary prescribing and independent prescribing by pharmacists exists in most provinces in Canada and other countries such as the U.S. and the U.K. The province of Alberta, Canada is a particular example due to having the largest scope of practice for pharmacists in North America. In Alberta, pharmacists are capable of independently prescribing Schedule 1 medications, (the Canadian designation for medications requiring a prescription for use) (22). While pharmacy is changing on a global level and other jurisdictions are considering different models of pharmacist prescribing, valid concerns regarding the efficacy and safety of pharmacist prescribing have been raised, prompting evaluation and research to further characterize pharmacist prescribing.

Chapter 2.3: Concerns regarding pharmacist prescribing

In response to the changes in pharmacist roles, studies have been conducted to ascertain the perceptions and views of various stakeholders with respect to the practice of pharmacy, namely pharmacists, patients, healthcare system leaderships, as well as other healthcare professionals such as physicians (7, 23, 24). The research has provided evidence of mixed views regarding expanded pharmacy scope of practice, specifically pharmacist prescribing. Most parties viewed prescribing as a logical development of pharmacist expertise and a boon for increasing healthcare access for patients, but strongly reported the need for additional training to be required for pharmacists as well as limitations in terms of the prescribing role (24). Cautious development of pharmacy prescribing was the consensus of all respondents. Responses to surveys and interview studies have voiced various concerns such as (24):

- clinical concerns, e.g., the lack of training that pharmacists receive in terms of clinical assessment and diagnosis,
- logistical concerns, e.g., potential for discrepancies in medical records,

- medico-legal concerns, e.g., fragmentation of care and unclear professional liabilities.

Clinical concerns were also expressed to be the largest barrier to the development of pharmacist prescribing roles (24). The current clinical focus of pharmacists is the identification, monitoring, and resolution of drug-related problems and as such the training of a pharmacist differs from the training of other prescribers such as physicians. These differences have put into question how effective pharmacists can act as prescribers. Yet, the majority of studies conducted regarding prescribing pharmacists have only analyzed the perceptions and opinions of stakeholders, prompting the question of: Is pharmacist prescribing effective, safe, and appropriate? Therefore, more evidence and research into the capabilities and competencies of current prescribing pharmacists is required to answer such a question. Studies that measure and evaluate the clinical reasoning or clinical decision-making of practicing pharmacists in prescribing roles would help characterize the kinds of choices that pharmacists make to as well as elucidate the thought processes that underlie such decisions. The primary purpose of this thesis was to provide baseline evidence regarding similarities and differences the clinical decisions made between prescribing pharmacists and their family physician counterparts when addressing common ambulatory cases.

Chapter Three: Background in Clinical Reasoning/ Decision-Making

Chapter 3.1: Defining clinical reasoning and other constructs of interest

In this chapter, I review relevant terminology used in this thesis as well as terminology use in the current literature. The purpose of this chapter is to define and make explicit the constructs of interest in this thesis. In this chapter I discuss the gaps in the clinical reasoning and clinical decision-making research within the field of pharmacy that this thesis seeks to resolve.

Clinical reasoning and similar terms such as clinical judgement and clinical competency are often used interchangeably in the literature but often have different contexts (25, 26) . These terms are defined and interpreted differently both within and between healthcare disciplines. The purpose of this section to define various terms that will be used hence forth.

Clinical assessment: This term will be used to primarily refer to the act of a healthcare professional interacting with a patient within the appropriate scope of practice to provide care (27). During such an interaction, the professional will communicate with the patient and use any appropriate examination skills. The term ‘assessment’ tends to be a more inclusive or all-encompassing term used to describe the actions of various healthcare professionals (27, 28).

Clinical reasoning: This term will be used to primarily refer to the cognitive processes during which all healthcare professionals utilize their knowledge and experience to perform a clinical assessment of a patient (25, 29, 30). Clinical reasoning is used during the clinical assessment to determine the course of action the professional wishes to take. Clinical reasoning is described as the hallmark feature of a healthcare professional, the essential skill that defines the abilities and activities that healthcare professionals engage patient care with.

Clinical decision-making: This term will be used to primarily refer to the acts, applications, and outcomes of clinical reasoning processes that go on to effect patient care; the result of clinical reasoning (25). When used with the above terms, during a clinical assessment, clinical reasoning is used to perform clinical decision-making. The goals of clinical assessments, clinical reasoning, and clinical decision-making are context-dependant, and these terms must be used within the context of a particular field or scope of practice to be functional. Clinical decision making can be further specified into other clinical aspects such as diagnostic decision making (see “diagnosis” below) and therapeutic decision making of which drug therapies are of particular importance for this thesis (see “prescribing” below).

Diagnosis: This term will be used to primarily refer to the process of determining a disease or condition (31, 32). Diagnosis is typically the goal of a clinical assessment, and traditionally the purview of a medical physician.

Prescribing: This term will be used to primarily refer to the process of generating a prescription, i.e., the formal documentation of the advice and authorization of a healthcare professional regarding the use of therapies, especially drug therapy (19). Prescribing generally follows a diagnosis through which the healthcare professional provides advice and actions to help manage or alleviate the disease or condition being diagnosed. Traditionally, prescribing has been the purview of a medical physician.

Historically, medical schools have aimed to train medical students in the procedures and associated scientific knowledge required to formulate a diagnosis. The term “diagnosis” is explicitly expressed in formal documents that govern physicians, their scope of practice, and in their training (33). However, as other professional scopes of practice expand, the term “diagnosis” has been used in more contexts and has become increasingly contentious (32).

Nursing literature has presented diagnosis in the context of both nurse practitioners who can act as independent healthcare providers as well as in the context of a nursing assessment to develop a nursing diagnosis, a determination about an individual, family or experience response to health problems (34). Training documents for pharmacists indicate competency in determining actual and potential drug therapy problems including the identification of relevant physical or laboratory signs and symptoms (35). Pharmacists also typically receive training in the assessment of symptomatic complaints in the provision of over the counter (OTC) medications i.e., non-prescription medications (36). Both activities sound like “diagnosis” but are worded to carefully avoid the label. Similarly, the term “prescribing” has been utilized different healthcare providers namely nurse practitioner as well as pharmacists. While the terms “diagnosis” and “prescribing” are overtly absent from most formal documents regarding pharmacists’ activities (37), pharmacists have been made, intentionally or not, to act as diagnosticians and prescribers in various degrees (14). Therefore, to determine the effectiveness of prescribing pharmacists in diagnostic behaviour, clinical reasoning research in pharmacists is paramount.

Chapter 3.2: Clinical decision-making and clinical reasoning research in pharmacy

While clinical reasoning is considered an essential part of healthcare professionals, research into describing and influencing clinical reasoning as a cognitive psychological phenomenon largely began with the work of Elstein et al. in 1978 introducing the concept of diagnostic hypothesis testing (38). However, compared to other healthcare professional fields such physicians, research into clinical reasoning and clinical decision-making has been only recently broached in the field of pharmacy (14, 39). The relative recency of clinical reasoning research in pharmacy could be attributed to the similarly recent expansion of pharmacist roles. Drawing from the established literature, clinical reasoning research and clinical decision-making

research in pharmacy has sought to identify the cognitive processes utilized by pharmacists, determine the efficacy and appropriateness of pharmacist actions and interventions, and influence the training of pharmacists (40).

Clinical reasoning research with respect to diagnostic behaviour in pharmacists is distinctly lacking in the literature. Qualitative methodology such as the think-aloud method coupled with thematic analysis have been highly prominent in pharmacy research for describing the clinical process of pharmacists (41-50). By prompting respondents to verbalize their thoughts and expressions, think-aloud techniques allow researchers to elicit aspects of individual thought processes. Table 1 provides a list of select primary literature showing performance and behaviours exhibited by pharmacists during clinical reasoning or clinical decision-making research pertaining to diagnosing conditions or prescribing medications. In most studies, during information gathering, pharmacists used and referenced mnemonic devices as questioning frameworks. (48, 51). Mnemonic devices are learning tools that aid in the retention and retrieval of memorized information (52). Frequently used across different healthcare disciplines, mnemonics can serve as helpful reminders of vital steps or information (53). While mnemonic devices can be useful tools when used appropriately, the pharmacist respondents often could not rationalize why particular mnemonic devices would be used or how the information gathered was used to form diagnostic and therapeutic decisions (50). Often the diagnoses and product selection by the respondents was inappropriate which led authors to posit that while pharmacists have been provided diagnostic tasks, additional training and experience is required to properly engage in diagnostic clinical reasoning (8, 50). Other research has demonstrated that pharmacists report a lack of professional identity as makers of clinical decisions as well as a lack of preparedness for the responsibility associated with clinical reasoning (54). Educational

research into clinical reasoning in pharmacy have attempted to formally introduce topics of clinical reasoning into pharmacy education and provide an increased exposure in the clinical elements of pharmacy (55-59). Students and trainees typically report high levels of satisfaction and higher scores in post-interventional assessments, however there is a lack of prospective studies have been completed to measure the effect of educational interventions on pharmacists' clinical decision-making performance in the long term. Given that research into pharmacists' clinical reasoning has been relatively recent, published studies have been primarily descriptive using single case studies and interview-based methodologies. To compliment the findings of such research more methodologies will need to be employed. Quantitative research and similar assessments, such as the ones used in thesis, provide another method to broadly survey and assess many participants have not yet been used in the field of clinical reasoning in pharmacy. Survey assessments allows for a broader examination of clinical reasoning and decision-making of a larger number of participants and cases allowing for greater exploration of the performance and capabilities of prescribing pharmacists.

Table 1: A select review of primary literature specific to pharmacist and diagnostic decision-making

Study Name	Author(s)	Publication year	Country of study	Population(s) of interest	Research Design	Results
Evaluation of community pharmacists' recommendations to standardized patient scenarios	Rutter, Paul; Horsley, Emma; Brown, David.	2004	United Kingdom	Community pharmacists	Cross-sectional, stimulated patients utilizing 1 of 2 case studies (headache or abdominal pain) using checklist and semi-structured interview 28 pharmacists (14 per scenario)	<ul style="list-style-type: none"> - Pharmacists primarily asked confirmation and clarification questions, - Each scenario had 1 inappropriate diagnostic response
Do Professional Practices among Malaysian Private Healthcare Providers Differ? A Comparative Study using Simulated Patients	Alabid, Alamin Hassan M. A. ; Ibrahim, Mohamed Izham; Mohamed Hassali, Mohamed Azmi	2013	Malaysia	Community pharmacists and general practitioners (GPs)	Cross-sectional: Stimulated patients with 1 reoccurring presentation, guidelines compliance measured using checklists 40 visits to GP 100 visits to pharmacists	<ul style="list-style-type: none"> - GPs tended to ask questions associated with symptomology but did not follow disease guidelines appropriately - Pharmacists tended to provide more comprehensive counselling
Community Pharmacists Reasoning When Making a Diagnosis: A think-aloud study	Iqbal, Nadya; Rutter, Paul	2013	United Kingdom	Community pharmacists	Cross-sectional: 1 case study (sub-arachnoid hemorrhage) using think-aloud and semantic analysis 4 pharmacists	<ul style="list-style-type: none"> - Singular approach to reasoning using mnemonic - Poor result at formulating diagnosis and treatment selection
Does evidence drive pharmacist over-the-counter product recommendations?	Rutter, Paul; Wadesango, Edna	2014	United Kingdom	Community pharmacist	Cross section; semi-structured interview with content analysis 16 pharmacists	<ul style="list-style-type: none"> - Evidence of efficacy was not typically used as part of recommendations due to a lack of evidence regarding many OTC medications - Pharmacist decisions were primarily driven by personal experience,

						patient feedback and non-maleficence.
Decision making by community pharmacists when making an over-the-counter diagnosis in response to a dermatological presentation	Rutter, Paul; Patel, Jignaben	2015	United Kingdom	Community pharmacists	Cross-sectional: 1 case study (urticaria / “hives”) using think-aloud and semantic analysis 10 pharmacists	- Pharmacists used lines of questioning that focused on determining if referral was warranted - Symptomatic relief was primarily recommended
Pharmacists thought processes in making a differential diagnosis using a gastro-intestinal case vignette	Akhtar, Samira; Rutter, Paul	2015	United Kingdom	Community pharmacists	Cross-sectional: 1 case study (dyspepsia) using think-aloud and semantic analysis 8 pharmacists	- Mixed approaches to reasoning with primary reliance on protocol/ mnemonic led reasoning - Mixed results at formulating appropriate diagnosis and treatment selection
A qualitative study on community pharmacists' decision-making process when making a diagnosis	Sinopoulou, Vassiliki; Summerfield, Paul; Rutter, Paul	2017	United Kingdom	Community pharmacists	Cross-sectional: 1 case-study (headache) using think-aloud and thematic analysis 8 pharmacists	- Primarily approach to reasoning using mnemonics - Pharmacists reasoning was primarily motivated by product and risk-management
Evaluating the potential for pharmacists to prescribe oral anticoagulants for atrial fibrillation	Sandhu, Roopinder Kaur; et al.	2018	Canada	Community pharmacists	Cross-sectional: 3 cases studies (stroke prevention) administered in survey format 139 pharmacists	- Mixed results at determining eligible of patients for stroke prevention and selecting appropriate anti-thrombotic agent - Knowledge and confidence were major contributing factors in predicting success
A qualitative study exploring how pharmacist and nurse independent prescribers make clinical decisions	Abzour, Aseel; Lewis, Penny; Tully, Mary	2018	United Kingdom	Hospital pharmacists and hospital nurse independent prescribers	Cross-sectional: 3 cases studies per participant (cases changed based on participant declared areas of competency)	- Both participant groups demonstrated a distinct and similar pattern to reach a clinical decision,

					using think aloud and semi-structured interviews 10 pharmacists 11 nurse independent prescribers	like previously described models - Nurses focused on potential interaction with patients - Pharmacists focused on medical notes and laboratory results
An exploration of the perceptions of non-medical prescribers, regarding their self efficacy when prescribing, and their willingness to take responsibility for prescribing decisions	Cope, Louise; Tully, Mary; Hall, Jason.	2020	United Kingdom	Hospital pharmacists, nurses, and physiotherapists (all with prescribing authority) sampled from acute medical wards	Cross sectional, survey based in Bandura's Social Cognitive Theory 27 pharmacists 36 nurses 4 physiotherapists	- Pharmacists reported to be less responsible for prescribing decision as well as lower self-efficacy at dosing compared to other nonmedical prescribers
Exploring community pharmacists' clinical-decision making using think aloud and protocol analysis	Mallinder, Alica; Martin, Nataly.	2022	New Zealand (Central Auckland)	Community pharmacists	Cross sectional: 1 case study (bacterial conjunctivitis) using think aloud and protocol analysis. 15 pharmacists	- All pharmacists probed further before recommending an appropriate treatment - Pharmacists thought pattern could be modelled using dual processing theory, although heavy emphasis on analytical (type 2) thought

Chapter 4: Manuscript

Managing common ambulatory conditions: Exploring clinical reasoning performance between prescribing pharmacists and family physicians

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4. Ambulatory medicine
5. Vignettes

Highlights:

1. Prescribing pharmacists are a relatively new role wherein diagnostic and therapeutic decision making requires further characterization
2. Previous studies that analyze pharmacists' decision making are typically based on one clinical case qualitatively comparing prescribing pharmacists against other prescribing pharmacists
3. This study quantitatively compared the clinical reasoning performance of prescribing pharmacists and family physicians using a series of ambulatory outpatient conditions
4. No significant differences were found between either group concerning diagnostic accuracy, therapeutic accuracy, confidence in diagnostic choices, or confidence in therapeutic choices

Chapter 4.1 Abstract

Background: Prescribing is part of the expanded scope of practice for pharmacists in Alberta, Canada. Given these responsibilities, clinical reasoning becomes an essential skill for pharmacists. However, the research on pharmacist clinical decision-making has been limited. Previous studies have relied on qualitative analysis of pharmacist behaviour, typically using a singular clinical case. This study compared diagnostic and therapeutic decision-making between Additional Prescribing Authority (APA) pharmacists and family physicians using a set of common ambulatory clinical cases that both practitioners could encounter in the community as part of their daily practice.

Objectives: How do clinical reasoning performances and behaviours between APA pharmacists and family physicians compare during the assessment and prescribing for common ambulatory conditions?

Methods: Eight ambulatory clinical cases were developed by a panel of experts in both family medicine and pharmacy that were commonly encountered in both professions' daily practice. APA pharmacists and family physicians were invited to read the cases and respond with a likely diagnosis, recommended treatment, and confidence in therapeutic choices. The responses of 18 APA pharmacists and 9 family physicians in community practices were analyzed.

Results: There were no significant differences between APA pharmacists and family physicians between diagnostic accuracy, therapeutic accuracy, confidence in diagnostic choices, and confidence in therapeutic choices.

Conclusions: This study provides insights regarding the capabilities of prescribing pharmacists in the assessment of common ambulatory community conditions. No significant differences in

diagnostic and therapeutic scores suggests that APA pharmacists are making similar diagnostic and therapeutic decisions to family physicians. Future research could focus on examining the performance of prescribing pharmacists trained in different pharmacy education models, as well as their ability to provide clinical assessment in other specialties, or in more uncommon clinical scenarios.

Chapter 4.2 Background

Pharmacists are qualified healthcare experts in dispensing and advising on drug therapies. Traditionally, pharmacists have occupied a more passive role in healthcare systems as verifiers of prescription information. However, changes in healthcare environments such as increasing complexity in patients, and workforce shortages have required pharmacists to utilize their expertise in a more fulsome manner (60). As such, the global scope of practice for pharmacists has expanded beyond the standard role of dispensing medication to take on more active clinical roles such as assessing medication appropriateness (2, 11, 60). In Canada, the expanded pharmacy scope of practice has taken on 4 aims (10): a) pharmacists can dispense medications (as they have before), b) pharmacists can administer medications, c) pharmacists can manage medications by ordering and interpreting health tests, and d) pharmacists can prescribe medications.

Of the 4 aims, pharmacist prescribing represents a major change in pharmacy scope of practice and has been subject to a great deal of research. Previous literature has organized pharmacist prescribing into a spectrum ranging from supplementary prescribing to independent prescribing (9). Supplementary prescribing describes when pharmacists form explicit agreements with other prescribers, such as physicians, in which the agreement defines the scope of the pharmacists' prescribing. Independent prescribing allows pharmacists to prescribe without having to enter a formal relationship with another prescriber (physician). In all types of pharmacist prescribing, pharmacists are expected to act within their professional competencies and to connect with or refer to other healthcare professionals as appropriate. A prominent example of pharmacist prescribing is present in Alberta, Canada. While all pharmacists in Alberta are allowed to prescribe for the purposes of extending or adapting an existing

prescription, Albertan pharmacists can also attain Additional Prescribing Authority (APA) upon approval by the Alberta College of Pharmacy (11, 61). Established in 2007, APA pharmacists may prescribe to initiate (i.e., start patients on new therapy) Schedule 1 medications (i.e., Canadian designation for medications requiring a prescription, excluding controlled substances) independently. As of 2018, nearly 2500 pharmacists — nearly half of all active pharmacists in Alberta — held the APA designation (1), making independent prescribing pharmacists a commonplace provider in Alberta.

There has been growing interest regarding the appropriateness of expanding scopes of practice such as APA. Research has found many stakeholders, including pharmacists, physicians and patients, are cautious of pharmacist prescribing due to the presupposition that to appropriately prescribe medications, an appropriate diagnosis should be first made (24). However, schools of pharmacy primarily focus on training students in assessments to determine medication appropriateness and the identification of drug therapy problems (DTPs) (62). Despite generally cautious public attitudes, pharmacist prescribing models continue to be implemented in North America. Ontario, for example, has recently asked for province-wide feedback on a pharmacist prescribing legislation (13). Several reviews have demonstrated that across multiple clinical disciplines pharmacist-prescribed therapies result in similar, if not better, patient outcomes when compared to physician-prescribed therapies (63-65). In addition, patients report high satisfaction rates with pharmacist-prescribing (66, 67). In the majority of studies of pharmacist prescribing, the framework of the study analyzes the initiation or changing of medications given a prior diagnosis, often in a multidisciplinary setting (63-65, 68). Yet, there is significant pressure from various sources, such as patients and employers, for pharmacists to manage ambulatory or “minor” illnesses in the outpatient setting (69, 70). The management of

these ambulatory conditions often require the pharmacist to establish a diagnosis or at the least obtain diagnostic information. There are fewer studies looking at how pharmacists would approach independent prescribing for ambulatory conditions. Studies conducted primarily in the United Kingdom have qualitatively assessed pharmacist management of certain conditions (48, 71-74). The evidence from these studies showed pharmacists largely demonstrated risk-averse behaviors and engaged in rigid protocols to gather clinical information, resulting in substandard diagnostic responses. The data from the studies are limited as the analysis is predominately qualitative and based on a single clinical case per study whereas providers in community settings should expect high diversity and variability in clinical presentations. As such, a broad assessment of the capabilities and behaviors of prescribing pharmacists towards the diverse presentations in ambulatory settings is warranted. Therefore, the objective of the study was to examine the performance of prescribing pharmacists when presented with a range of common ambulatory conditions requiring drug therapy or advice. As many of these ambulatory conditions are also presentations commonly seen in the discipline of family medicine or primary care, both prescribing pharmacist and family physician responses to a variety of clinical vignettes were compared in a survey based approach. The hypothesis was: given the previously identified differences in training, knowledge, and experience, pharmacists would demonstrate lower performance diagnostic and therapeutic decision-making and lower confidence.

Chapter 4.3 Methods

Setting and participants

The study took place in the province of Alberta, Canada. Participants included in the study were either prescribing pharmacists or family physicians practicing in community settings (non-hospital) in Alberta. Prescribing pharmacists must have acquired the “Additional Prescribing Authority (APA)” designation (75, 76). In Alberta, pharmacists are regulated by the Alberta College of Pharmacy which also grants the APA status to eligible pharmacists. Pharmacists can attain APA status after being on the clinical registrar for at least 1 year or by graduating from an accredited Canadian Doctor of Pharmacy program starting in 2018; must demonstrate strong collaborative relationships with other regulated healthcare professionals; must demonstrate and maintain the necessary knowledge, skills, abilities, and clinical judgement to enhance patient care; and must demonstrate the required supports to enable safe and effective management of drug therapy (76). These factors are assessed in an application which includes a professional narrative describing the applicant’s competencies and limitation as well as 3 clinical cases describing the applicant’s care process.

Family physicians in Alberta are regulated by the College of Physicians and Surgeons of Alberta. Graduates of Canadian Medical Doctor (MD) programs must first complete a family medicine residency program and pass the Certifying Examination in Family Medicine by the College of Family Physicians of Canada, prior to independent practice as a family medicine physician (77, 78). For the study, no restriction was placed on age, length of practice or type of training for either participant group.

Study design

The survey was delivered in an online format and included demographic questions to organize participants into 2 major groups — prescribing pharmacists and family physicians. To elicit relevant demographic and practice characteristic information, the following were also collected: gender identity, time in practice, relevant degree status, and frequency of APA usage. The survey preamble was used as a part of the informed consent process as well as to detail how the survey had no correct responses and that the participants should respond as they would in real-life. There were no time deadlines for individual cases or for the survey as a whole, however, participants were given a guide that the survey could be completed in approximately 30 minutes.

Following the demographic information, participants were presented with the 8 clinical cases in a randomized order. For each clinical case, the participants were asked to provide a free text, written (constructed) response with their assessment of likely diagnosis (Dx) and a likely drug therapy to be prescribed (Rx). Participants were asked to rate their confidence regarding their diagnostic and therapeutic decisions (designated as Dx and Rx confidence, respectively) on a 5-point rating scale. Participants were also given the option to detail any other actions of care they may wish to take (designated as other treatments [Tx]). At the end of the survey, participants were given the option to contact the study coordinator for a list of expert responses pertaining to each case.

Case development

A panel consisting of 5 personnel, recruited via invitation, with expertise in family medicine, pharmacy education, survey design, pharmacy practice, and educational assessment, including authors VC, KH, LG, and DT. The panel built a blueprint of potential ambulatory conditions that were frequently discussed in pharmacy literature. From the blueprint, 8 cases were developed

and piloted. Case development focused on ambulatory *de novo* clinical presentations (i.e., the first time a patient has sought help for a condition). The criteria that were used during the blueprinting process focused on cases that were non-emergency conditions, which could reasonably be managed in an out-patient setting, would not require extensive clinical or laboratory investigations, and had the potential to be treated using prescription medication therapy. The cases also covered a variety of organ-systems (e.g., respiratory, dermatologic, urogenital, etc.) and a variety of causes (e.g., bacterial infection, viral infection, injury, etc.). The clinical case vignettes were standardized to approximately 90 –100 words, containing relevant clinical information such as allergy and medication history, clinical signs or symptoms experienced by the patient, duration and intensity of symptoms, and additional relevant information. The cases were piloted with a group of 5 family medicine residents and 2 pharmacists to ensure content validity. Based on feedback, minor adjustments to the clinical case details were made to reduce ambiguous wording. The 8 finalized cases were as follows (Example case depicted Figure 1):

- uncomplicated cystitis
- bilateral bacterial conjunctivitis
- atopic dermatitis
- bacterial pharyngitis
- allergic rhinitis
- gout
- herpes zoster
- acute musculoskeletal pain

Figure 1. Clinical Case Example.

Please read the following information, while reading highlight up to three (3) pieces of information that you found most relevant to this case. To highlight, click/ drag on the word(s) you wish to highlight and click "Relevant" above it to confirm your selection.

A 20-year-old woman presents to you with increasing urinary frequency, along with increased urgency and dysuria for the past 2 days. She reports that her urine is brownish, but does not have any unusual odor, neither does she reports any genital lesions or vaginal discharge. The patient has no previous history of similar complaints. However, she has recently become sexually active and has been using a diaphragm with spermicide as contraceptive. She does not take any other medications and has only tried cranberry juice to combat the symptoms. She reports that she has known allergies or other conditions.

Based on your assessment, what do you believe is the most likely diagnosis at this time?

Based on your assessment, what drug therapy do you believe is most appropriate at this time?

Please indicate your selection including drug, dose, direction, and duration? If NO drug therapy is appropriate, please indicate so.

If other actions are needed to manage this case, please indicate so.

How confident are you in your responses?

	Not confident	Slightly confident	Somewhat confident	Fairly confident	Very confident
Diagnosis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Treatment selection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Recruitment

Participants were recruited via convenience sampling to complete the online survey through distribution lists and newsletters through the University of Alberta, University of Calgary, and the Alberta Medical Association. The recruitment information detailed the aim of the survey and was part of the informed consent process. Participants were included if they were prescribing pharmacists or family physicians practicing primarily in outpatient community settings in Alberta. All participants voluntarily provided informed consent at the beginning of the survey and were allowed to leave at any stage of the survey. The protocol was approved the University of Calgary Conjoint Health Research Ethics Board under study ID: REB20-1770. Participants were recruited over 7 months from Feb 2021- Sep 2021. Due to the concurrent COVID-19 pandemic, significant difficulties were experienced in recruitment which accounts for the long duration of recruitment.

Analysis

A 3-point scoring key was used for each clinical case to determine accuracy of the Dx and Rx responses (0 = unacceptable response; 1 = disputable response; 2 = acceptable response). The key was developed alongside the cases using an expert panel of non-participating family physicians and prescribing pharmacists, including author DT, and scored by VC. The scores were then summed across all cases to achieve a total possible Dx score and Rx score of 16 per participant. Discrepancies were adjudicated by an experienced family physician (DT). Dx confidence and Rx confidence were scored on a 5-point scale (1 = Not confident; 2 = Slightly confident; 3 = Somewhat confident; 4 = Fairly confident; 5 = Very confident). Confidence scores were averaged across all cases to a total possible Dx and Rx confidence score of 5 per participant.

Statistical analysis

Between group differences were analyzed using the non-parametric Mann-Whitney *U* test with effect sizes computed using the formula $r_U = |Z|/\sqrt{N}$ where *Z* is the standard test statistic and *N* is the number of pair observations (79). Within group differences were computed using Pearson product-moment correlation coefficient (*r*). An α of 0.05 was set for significance. Data were collected in Qualtrics (Qualtrics, Provo, UT) and analyzed using Microsoft Excel (Microsoft Company, Redmond, WA) and SPSS version 26 (IBM, Armonk, NY).

Chapter 4.4 Results

Response rate

Given the exploratory nature of this study, a convenience sample of 19 prescribing pharmacists and 10 family physicians in Alberta were recruited. One prescribing pharmacist response and one family physician response were identified as outliers due to the responses appearing consistently and intentionally erroneous. The resulting data left a total of 27 responses (18 prescribing pharmacists and 9 family physicians) for analysis.

Demographic characteristics

The majority of prescribing pharmacists identified as female (n=13), and as being in active practice for less than 10 years (n=11). The most common training reported by the prescribing pharmacist was a Bachelor of Science in Pharmacy or equivalent, with 2 respondents having Doctor of Pharmacy degrees. The respondents were commonly practicing full-time (n=14) and in large urban settings (n=11). (Table 2a)

Table 2a. Demographic characteristics: Pharmacists

Pharmacist	Gender	Length of active practice	Training	Practice status	Year APA attained
1	Female	< 5 years	PharmD	Full-time	2020
2	Female	< 5 years	PharmD	Full-time	2020
3	Male	< 5 years	BSc Pharm or equivalent	Full-time	2019
4	Female	6 - 10 years	BSc Pharm or equivalent	Full-time	2015
5	Prefer not to say	11 - 15 years	BSc Pharm or equivalent	Full-time	2018
6	Female	6 - 10 years	BSc Pharm or equivalent; and PharmD	Full-time	2015
7	Female	< 5 years	BSc Pharm or equivalent	Full-time	2018
8	Female	6 - 10 years	BSc Pharm or equivalent	Part-time	2019
9	Female	> 25 years	BSc Pharm or equivalent	Part-time	2020
10	Female	6 - 10 years	BSc Pharm or equivalent	Part-time	2017
11	Female	11 - 15 years	BSc Pharm or equivalent	Full-time	2013
12	Female	< 5 years	BSc Pharm or equivalent	Full-time	2020
13	Female	16 - 20 years	BSc Pharm or equivalent	Full-time	2018

14	Male	6 - 10 years	BSc Pharm or equivalent	Full-time	2015
15	Male	< 5 years	PharmD	Full-time	2018
16	Male	11 - 15 years	BSc Pharm or equivalent	Full-time	2017
17	Female	> 25 years	BSc Pharm or equivalent	Full-time	2017
18	Female	11 - 15 years	BSc Pharm or equivalent	Part-time	2016

The majority of family physicians identified as female (n=6), and as being in active practice for more than 10 years (n=6). Only one family physician reported having another professional degree beyond a Doctor of Medicine degree, which was BSc Pharm, indicating previous pharmacy experience. The respondent family physicians were commonly practicing full-time (n=5) and in large urban settings (n=6). (Table 2b)

Table 2b. Demographic characteristics: Physicians

Physician	Gender	Length of active practice	Training	Practice status	Year residency completed
1	Female	> 25 years	MD or equivalent	Full-time	1991
2	Female	> 25 years	MD or equivalent	n/a	n/a
3	Female	6 - 10 years	MD or equivalent	Full-time	2015
4	Female	< 5 years	MD or equivalent	Part-time	2015
5	Female	6 - 10 years	MD or equivalent	Full-time	2012
6	Male	11 - 15 years	MD or equivalent	Part-time	2007
7	Female	> 25 years	MD or equivalent	Full-time	1989

8	Male	> 25 years	MD or equivalent	Not currently working	1982
9	Male	> 25 years	MD or equivalent	Full-time	1984

Score analysis

Out of a total possible score of 16, the median Dx score for prescribing pharmacists was 15, ranging from 12-16; and median Rx score for prescribing pharmacists was 14.5, ranging from 10-16. The median family physician Dx score was 15, ranging from 14-16; and median family physician Rx score was 15, ranging from 10-16. On a 5-point scale, the median Dx confidence and Rx confidence reported by prescribing pharmacists across all cases was 3.6, ranging from 2.88-4.63; and 3.94, ranging 2.88-5, respectively. Whereas the average Dx confidence and Rx confidence reported by family physicians was 3.88, ranging from 1.75-5; and 4.38, ranging from 3-5; respectively. Prescribing pharmacists scored lower diagnostic accuracy ($U = 51.5, p > 0.05, r_U = 0.32$) (Figure 2a), higher therapeutic accuracy ($U = 73.3, p > 0.05, r_U = 0.08$) (Figure 2b), and reported lower confidence in both diagnostic choices ($U = 45.00, p > 0.05, r_U = 0.36$) (Figure 3a) and therapeutic choices ($U = 55.0, p > 0.05, r_U = 0.26$) (Figure 3b) when compared to family physicians, but there was no significant difference in the distributions of any of the above measures (Table 3).

Across all participants, there was a medium, non-significant, positive correlation between diagnostic accuracy and therapeutic accuracy ($r = 0.36, p > 0.05$); a small, non-significant, positive correlation between diagnostic accuracy and diagnostic confidence ($r = 0.22, p > 0.05$); no correlation between diagnostic score and confidence in therapeutic choices ($r = 0.03, p > 0.05$); a medium, significant, positive correlation between therapeutic accuracy and confidence in diagnostic choices ($r = 0.39, p < 0.05$); a medium, non-significant, positive correlation between

therapeutic accuracy and confidence in therapeutic choice ($r = 0.31, p > 0.05$); and a large, significant, positive correlation between confidence in diagnostic choice and confidence in therapeutic choice ($r = 0.86, p < 0.001$) (Table 4).

Table 3.

Performance and reported confidence between pharmacists and physicians

Group	Median Total Dx Score \pm IQR	Median Total Rx Score \pm IQR	Median Dx Confidence per case \pm IQR	Median Rx Confidence per case \pm IQR
Pharmacist	15 \pm 1	14.44 \pm 3	3.625 \pm 0.62	3.94 \pm 0.75
Physician	15 \pm 1.5	15 \pm 3	3.88 \pm 1.12	4.38 \pm 1
<i>U</i>	51.5	73.3	45.0	55.0
<i>p</i>	0.099	0.674	0.063	0.179
<i>r_U</i>	0.32	0.08	0.36	0.26

Table 4.

Correlations of Performance and reported confidence across all participants

Correlation	<i>r</i>	<i>p</i>
Dx Score to Rx Score	0.362	0.064
Dx Score to Dx Confidence	0.224	0.261
Dx Score to Rx Confidence	0.030	0.881
Rx Score to Dx Confidence	0.389	0.045
Rx Score to Rx Confidence	0.312	0.113
Dx Confidence to Rx Confidence	0.858	< 0.0001

Figure 2a. Dx scores between pharmacists and physicians

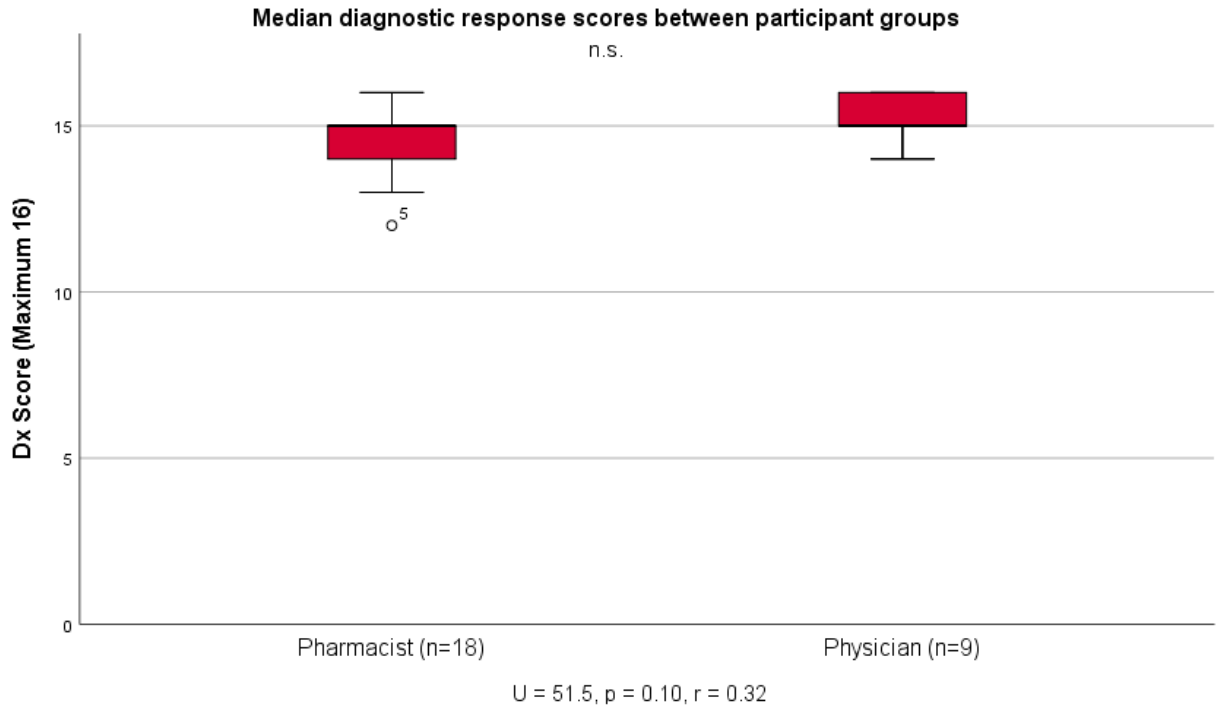


Figure 2b. Rx scores between pharmacists and physicians

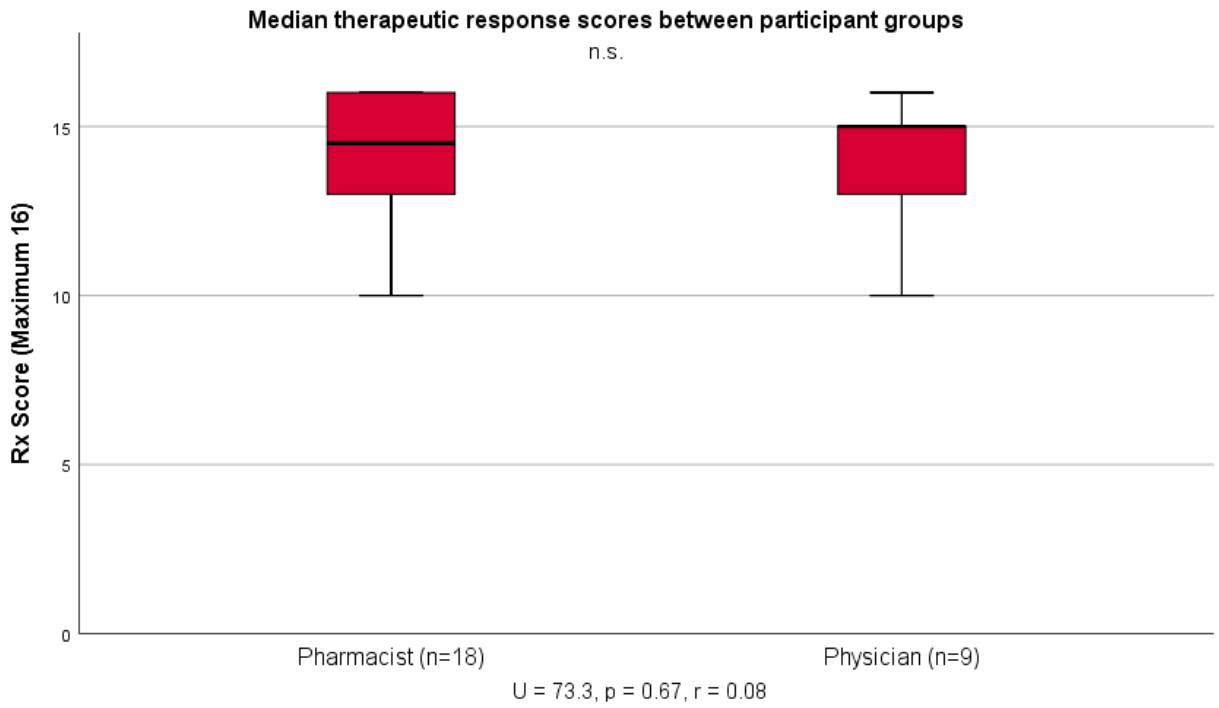


Figure 3a. Dx confidence between pharmacists and physicians

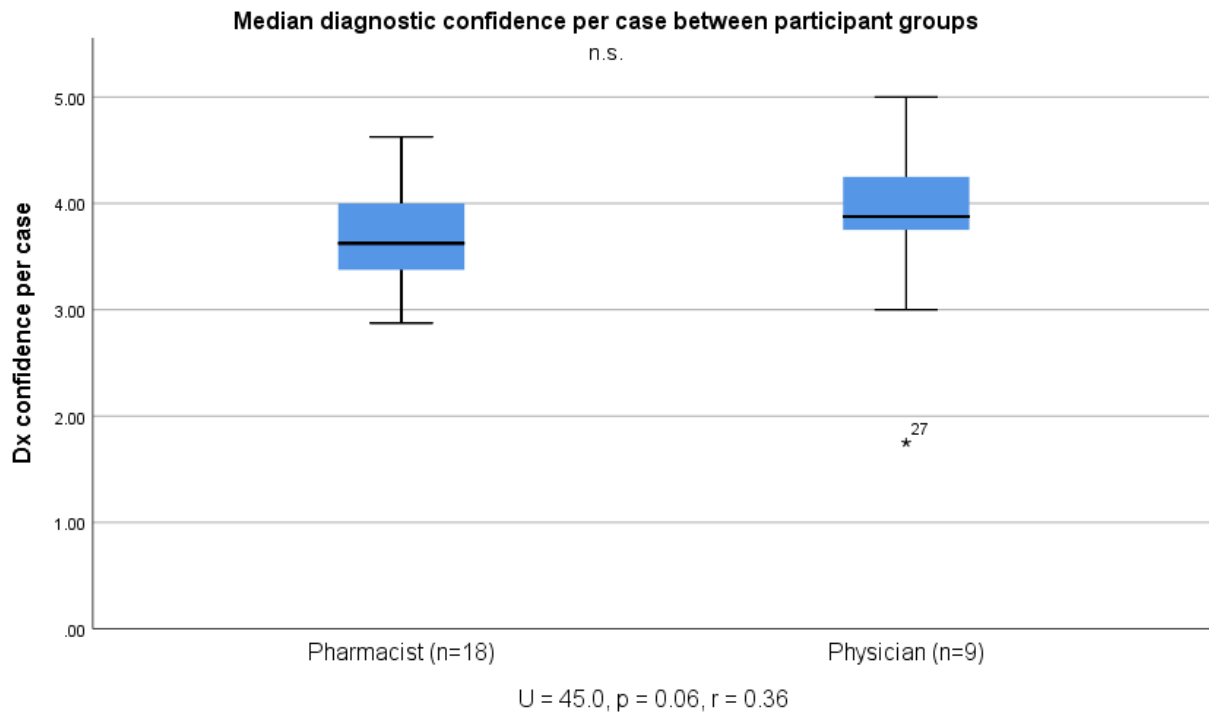
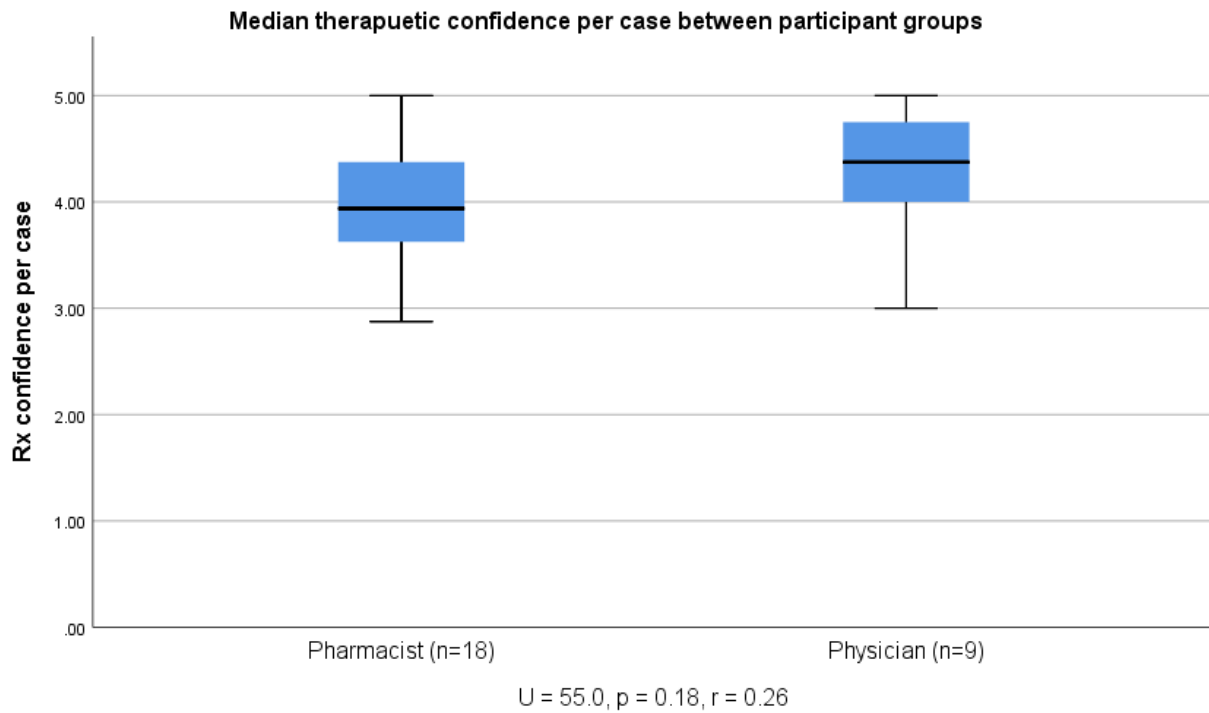


Figure 3b. Rx confidence between pharmacists and physicians



Chapter 4.5 Discussion

The purpose of this research was to assess the performance of prescribing pharmacists in the diagnosis and management of common outpatient conditions when compared to family physicians. The hypothesis was that pharmacists would demonstrate lower performance diagnostic and therapeutic decision-making and lower confidence. The overall main findings were that there were no significant differences in the diagnostic and therapeutic accuracy between prescribing pharmacists and family physicians when evaluating clinical vignettes of common ambulatory cases as well as no significant differences in confidence in diagnostic and therapeutic choices between groups. This finding indicates that prescribing pharmacists in Alberta provided similar responses to their family physician colleagues and potentially extrapolates that prescribing pharmacist are capable to appropriately diagnosis and manage a wide variety of ambulatory conditions in the outpatient setting.

Previous studies have shown that pharmacists tend to demonstrate mixed results when tasked with diagnostic assessments (71-73, 80). The majority of these studies were conducted in the United Kingdom and focused on one single prototypical scenario usually requiring urgent or emergency care. Whereas the current study demonstrated a sample of prescribing pharmacists in Alberta that provided diagnostic and therapeutic assessments to a breadth of clinical presentations that were similar to the decision-making demonstrated by family physicians' counterparts. While the pharmacists did score lower in diagnostic assessment and higher in therapeutic assessment, the differences were not significant. The lower Dx scores and higher Rx scores of family physicians are most likely due to the training of pharmacists which prioritizes medication appropriateness over diagnostics training. Pharmacists have typically demonstrated superior knowledge at pharmacology and pharmacotherapeutics in previous studies (15). The

current study provides evidence that prescribing pharmacists in Alberta can provide proper assessments of a multitude of ambulatory outpatient conditions in a manner that is similar to family physicians.

Pharmacists self-reported similar confidence in both diagnostics and therapeutic choices compared to the family physicians. Lower confidence has been reported in pharmacists previously in the literature during experimental studies and has been identified as a perceived barrier to the prescribing pharmacists (54). However, both prescribing pharmacists and family physicians demonstrated similar average median self-reported confidence scores in both Dx confidence (3.6 vs 3.88) and Rx confidence (3.94 and 4.38). The confidence from both professional groups potentially stems from the limitations of the clinical vignette design as more information is often warranted to make highly confident decisions. Risk aversion has been reported as a general trait of pharmacists who reported a duty and role to act as “safety nets” in the healthcare team during the provision of care (81-83). Further education may be necessary to support pharmacists in practice and in training when taking on new roles as prescribers, particularly education in diagnostic and therapeutic selection. As such, an important avenue of future research should aim to evaluate potential differences in the performance of pharmacists as the Doctor of Pharmacy (PharmD) designation becomes the new educational standard for pharmacists in Canada. PharmD curricula across North America are purported to increase the clinical training of pharmacy students in an effort to match the expanding role of pharmacists (35, 84). In this study, only 3 out of 18 pharmacists held a PharmD which was insufficient to determine any significant differences. Continuing education or additional training following entry into practice has been highlighted as necessity to engage as prescribing pharmacists (24, 85, 86). Therefore, further studies that compare PharmD degree holding pharmacists to previous

pharmacy degrees holders (e.g., B. Sc. Pharm) and if determining whether continuing education programs are necessary to assist practicing pharmacists in improving both skill and confidence in diagnostics and therapeutic selection. Transition in the entry-to-practice degrees have been seen before, particularly in physical therapy. In the Canadian context of physical therapy, the Bachelor of Science in Physical Therapy has transitioned into the Master of Physical Therapy with the last program being phased out in 2012 (87). A 2014 study of attitudes and perceptions regarding the degree transition demonstrated that participants perceived the master's degree as helpful for integrating research into clinical practice, most participants did not believe any changes or improvements to the healthcare system or to clinical reasoning as a result of the transition (87). No direct comparisons in the competency or skills have been conducted thus far, which has been noted by other physical therapy researchers as the profession grapples with considering another transition to Doctor of Physical Therapy degrees (88).

While this study provides evidence that prescribing pharmacists in Alberta may be capable of independent assessment of ambulatory outpatient conditions, pharmacist prescribing exists on a spectrum from independent to supplementary (11, 68, 89). During supplementary prescribing, pharmacists share the responsibility of prescribing with other healthcare providers often in formal relationships. As such, another area of future research would be to characterize and understand the clinical decision-making and underlying clinical reasoning processes that contribute to the partnerships of pharmacists and physicians. Supplementary prescribing for pharmacists is a more common model of pharmacist prescribing globally than independent prescribing yet supplementary prescribing still remains understudied.

A limitation of the study is the small sample size. An *a priori* power calculation indicated that approximately 25 participants per group would be needed to see significant differences

based on previously established studies comparing pharmacists and physicians with respect to pharmacotherapy examinations. As a small sample size is impacted more by skewed data and outliers as well as less likely to follow a normal distribution, we employed non-parametric analysis in order to determine significance differences in the distribution of the data. Unfortunately, the study was performed during the peak of the COVID-19 pandemic of which many prescribing pharmacists and family physicians were beleaguered and overworked. As such, the participation in extraneous research studies, especially those involved in active patient care, may not have been a priority for many potential participants. This may also have skewed the sample as our sampling of convenience may have biased participation to prescribing pharmacists and family physicians with a high degree of interest in ambulatory care and prescribing practices. As such, there is a potential that our data may not be fully generalizable to the population.

Another limitation is the survey-based study design which reflects idealized approaches that the participants would take rather than what would happen in real-life practice. Attempts were made to place the participants workplace-like mind-frame by detailing the recommended time limit and perspective into the study preamble. Workplace based assessments such as the use of standardized patients/shoppers have been used to assess pharmacist performance before, but little has been done to assess prescribing pharmacists' performance towards ambulatory conditions (80, 90, 91). Little has been done to understand the clinical reasoning of pharmacists in terms of their new roles as prescribers. A potentially novel methodology that has gained recent attention has been the use of non-invasive psychophysiological measurement such as electroencephalography (EEG) or functional magnetic resonance imaging (fMRI) to measure brain activity as correlates of clinical reasoning and decision-making (92), a technology that may be useful in future studies.

In conclusion, the above study describes a sample of prescribing pharmacists in Alberta being assessed using a survey of variety of common clinical vignettes. Diagnostic and therapeutic choices regarding common ambulatory conditions as well as confidence in those choices were measured using a sample of family physicians as a standard for comparison. Prescribing pharmacists did not perform significantly different to the family physician in diagnostic or therapeutic accuracy. Prescribing pharmacists also did not report significantly different confidence in diagnostic or therapeutic choices than family physicians. The study provides evidence that prescribing pharmacists in Alberta perform similarly to family physicians when managing common ambulatory outpatient conditions.

Chapter 5: Discussion and conclusions

5.1. Overview of results

A sample of 18 prescribing pharmacists and 9 family physicians from Alberta provided responses to a survey consisting of 8 common ambulatory clinical cases. Participants were asked to provide diagnostic and therapeutic responses, as well as to indicate their confidence in the responses in each case. Overall, there were no significant differences in the diagnostic and therapeutic scores between the two groups. In addition, there were no significant differences in the self reported confidence in both diagnostic and therapeutic choices between prescribing pharmacists and family physicians. The findings demonstrate that, with respect to common clinical cases of ambulatory conditions that both groups would likely encounter, the performance and behaviours of a sample of prescribing pharmacists were consistent with the performance and behaviours of a sample of family physicians, in the Alberta context.

5.2. Implications of findings

The findings provide baseline evidence indicating that prescribing pharmacists are making clinical decisions similar to their family physician counterparts, as well as reporting similar confidence in the choices that are being made. With the changes in prescribing roles, most studies to date of pharmacist clinical decision-making typically have used single case study designs and qualitative methods to explore the clinical reasoning processes (48, 71, 72, 93). The result of the current study adds to the literature by using a multi-case study design of a range and variety of ambulatory cases common to community pharmacy and physician practice, and comparison group to allow for a broad characterization the performance of prescribing pharmacists when encountering a variety of common ambulatory conditions. Influenced by

studies such Keijsers et al. 2014 and 2015 that compared pharmacotherapy knowledge between pharmacists and family physicians (15, 94), this approach provides some of the first evidence of the general capacity of pharmacists when applying their skills to fulfil prescribing roles in the treatment of ambulatory conditions.

The results suggest that during ambulatory cases within an Albertan context, prescribing pharmacists and physicians provide similar diagnostic and treatment decisions. These results show the potential for prescribing pharmacists to manage a wide variety of ambulatory conditions in the outpatient setting, independently, confidently, and appropriately. While the pharmacists did score lower in diagnostic assessment and higher in therapeutic assessment, the differences were not significant. The lower Dx scores and higher Rx scores of prescribing pharmacists are most likely a consequence of pharmacy training which prioritizes medication appropriateness over diagnostics training – congruent with previous studies where general pharmacists demonstrating high knowledge scores in pharmacology and pharmacotherapeutics (15).

In contrast with previous single case studies that found prescribing pharmacists demonstrated poor diagnostic reasoning skills, risk adverse behaviour, and low confidence, (44, 45, 48, 50, 51, 73, 82), this study showed a sample of prescribing pharmacists that did not significantly perform lower than their family physician counterparts in both diagnostics and in self-reported confidence. The findings in this thesis represent a positive baseline of prescribing pharmacists' performance and behaviour for further studies and characterization of pharmacist performance such as determining readiness for practice. All 8 Canadian provinces and territories where pharmacists can prescribe for ambulatory conditions have different mandatory requirements by the regulatory pharmacy bodies before being able to prescribe (11). For

example, Albertan pharmacists must undergo an application process where in 3 clinical cases are submitted by the applicant for evaluation by the Alberta College of Pharmacy (76). In Manitoba and Newfoundland & Labrador, pharmacists must complete courses prior to application (95). In all areas, continuing education for prescribing pharmacists is encouraged by all regulatory bodies. Continuous formal assessment of the performance and efficacy of prescribing pharmacists can help ensure high standards of care and patient safety. This study provides an example of a methodology that can be economical distributed to many participants for ongoing quality assurance of pharmacist prescribing skills.

5.3 Future directions

While the clinical scenarios used in this study were determined by an expert panel to be reasonable cases of ambulatory conditions, there are other ambulatory conditions not addressed in this study that can be studied in the future. This study focused on a select set of conditions appropriate for Alberta, Canada. Other Canadian jurisdictions that have approved or are in the process of approving prescribing pharmacists for ambulatory conditions have their own specific set of ambulatory conditions for which pharmacists can prescribe (96, 97). This study design can be adapted to local legislation and policies to assess pharmacist performance across the different jurisdictions, and local case prevalence to determine the appropriateness of prescribing pharmacist legislation, as well as determine future areas in which pharmacist prescribing can be effective. Understanding the practical scope and behaviour of current prescribing pharmacists is essential for guiding future research and development of the prescribing pharmacist role. In addition, workplace-based assessments that replicate real-world practice conditions or study pharmacists in their real-world positions are another important step in determining the efficacy, performance, and behaviours of prescribing pharmacists in actual or simulated patient care (98).

Risk and responsibility are important factors that need to be incorporated in future research to determine how appropriateness of the decisions that prescribing pharmacists make in real patient care.

As previously mentioned, the methodology of this study can also help guide assessment by educational institutions and regulatory bodies to help determine the effectiveness of prescribing pharmacists with regards to ambulatory conditions or assist in their remediation and/or continuing education. Further development of the methodology would be required prior to being implemented as an assessment instrument, such as addressing the various validity concerns. The scoring system currently relies on a single rater using a single expert response for each clinical case. Multiple raters and an expanded expert response panel would be necessary to reduce bias as well as testing the reliability this survey method evaluation to ensure consistency across various performance levels.

Another avenue for future research would be to compare the performance and behaviours of prescribing pharmacist with different training backgrounds. As of 2020, the first-professional degree for all pharmacy students became the Doctor of Pharmacy (PharmD) (99). However, most current practicing pharmacists were trained under Bachelor of Science in Pharmacy (BSc Pharm) or Bachelor of Pharmacy (BPharm) curricula. The PharmD curricula are intended to be more comprehensive and clinically oriented than the baccalaureate curricula with greater emphasis on experiential learning (99). This is evidenced by most schools of pharmacy offering after-degree or post-professional programs for current baccalaureate holders to obtain PharmD degrees (99). This transition aligns with the expansion of scope of practice for all pharmacists and represents an evolution in the role of pharmacy training to match new roles and overcome the current shortcoming of the healthcare system. In the study, only three prescribing pharmacist participants

identified as holding a PharmD out of 18, therefore accurate comparisons between the performance of different degree holders could not be done. Future studies could focus on determining the effects of education and training as well as if current baccalaureate holding pharmacists can be supplemented with continued education.

Other future studies could consider the role of prescribing pharmacists as supplementary prescribers. While family physicians were used as a comparison group in this study, collaborative studies that consider the clinical reasoning and clinical decision making between pharmacist and physician colleagues would provide valuable information as another aspect of pharmacist prescribing. Previous studies often examine the clinical outcomes of collaborative care initiatives between pharmacists and physician (100) or the perceptions that influence and define the relationships within collaborative care teams (101), however little has been done to understand the clinical reasoning present in collaborative care (102).

Lastly, another unique avenue of future research could be to measure psychophysiological markers of clinical reasoning and clinical decision making. Talk-aloud methods that are the most common technique used currently in clinical reasoning research are at best proxy measures of cognitive processes, limited by the direct verbalizations of participants and subjective analysis of statements (103, 104). Lack of verbalization can occur due to immersion within the research task, inability to articulate, cultural norms, or physical impediment (103). Even when participants verbalize, talk-aloud methods can only provide a perspective of the thoughts that enter active working memory, and automated thought or unconscious behaviours are not easily captured by talk-aloud methods (103). In addition, talk-aloud analysis is subjective and time-consuming. While this study used quantitative methods to capture a broad view of performance, nuances about cognitive processes underlying the

decisions were not captured. Triangulation, wherein multiple methods are used to investigate research questions, will provide the most comprehensive understanding possible.

Psychophysiological measures are physical markers that act in response to conscious and unconscious cognitive behaviour of participants. Tracking the movement of the eyes, for example, is a measurable physical response that has shown to help compliment talk-aloud methodology (105) as well as a stand alone measure for clinical reasoning research (106). Non-invasive cognitive neuroscience techniques have been incorporated into the research of clinical reasoning to overcome various limitations in current methodologies (92, 107, 108). By using concurrent methods such as electroencephalography (EEG), functional magnetic resonance imaging (fMRI), and functional near-infrared spectroscopy (fNIRS), to directly measure brain activity, we can ascertain correlates of clinical reasoning and clinical decision making to supplement other data or research (92, 109-112).

5.4. Limitations

There are several limitations to the findings of this study. Firstly, the low sample size utilized in this study limits the statistical analysis of the data. An *a priori* power calculation determined, based on differences in pharmacotherapy scores between general pharmacists and general practitioners in Sweden, that a sample size of 26 participants in each group would be required to detect an effect size Cohen's $d = .7$, given an $\alpha = .05$ and $\beta = .8$ (15). Given that this study did not reach that sample size, the design of this study is underpowered for detecting significant differences using similar parametric analyses. The underpowered design limited the analysis that can be done as the small sample size reduces analysis' ability to detect differences i.e., the sensitivity, and limits the generalizability of the data (113). However, given that this study was meant to be an initial exploratory examination, the findings still have utility in

providing, at the very least, a baseline understanding of performance. The study was not able to recruit the expected number participants in a reasonable timeframe. However, increasing participation recruitments would be an important step in increasing the power of the statistical inferences made. A factor that most likely impacted the recruitment of participants for this study was the ongoing COVID-19 pandemic. The participants required for this study –practicing pharmacists and family medicine physicians – were also among the most beleaguered and overworked healthcare providers at the center of patient care during the pandemic. As such, the participation in extraneous research studies especially involving active patient care may not have been desired by most potential participants in addition to the fatigue of day-to-day practice.

Another limitation is the convenience sampling method used to recruit participants (114). Convenience sampling was used due to the cost efficiency and the readily available nature of the target populations (prescribing pharmacists and family physicians) as well as the relative ease of which convenience sampling can recruit participants. However, convenience sampling introduces a sampling bias in which only interested parties are recruited and subgroups within the target populations of interest maybe under-represented lowering the generalizability of the findings. According to the Canadian Institute for Health Information’s survey, male-gendered pharmacists make up 40% of the Alberta pharmacist population in 2020, while only 20% of this study’s sample identified as male. In addition, the experience make-up of Alberta pharmacists, as measured by years in practice, is roughly equally distributed whereas this study’s sample was composed of 60% recent graduates with less than 10 years. The COVID-19 pandemic most likely exacerbated the sampling bias inherent to using convenience sampling in this study as probably the prescribing pharmacists and family physicians most interested in the subject of ambulatory care and prescribing would be interested in responding, and as such potentially the

data may not be generalizable to the whole population of pharmacists and physicians practicing in community settings. Sampling bias in future studies could be mitigated by using purposeful sampling by selecting specific participants to make up a representative sample or random sampling.

The survey methods utilized in this study may also introduce specific biases (115). For example, since the survey can be completed anytime and anywhere, the responses are more likely to represent idealized approaches towards the clinical scenarios rather than what the participants would in real-life under the pressures of actual clinical responsibilities. Attempts were made to mitigate these biases such as the introduction of the survey being structured to detail a recommended time limit. In addition, the structure, design, and information in the clinical cases or vignettes must be kept intentionally limited to make the study feasible. Because no additional clinical information can be provided, the clinical decisions made are reliant on assumptions made by the respondents (116).

5.5 Conclusions

To conclude, the objective of this study was to compare performance and behaviours of prescribing pharmacists with respect to prescribing using family physicians as a comparison group. We hypothesized that given previous evidence in the field regarding the experience and education of pharmacists, prescribing pharmacists would demonstrate lower proficiency in the selection of diagnostic and therapeutic choices regarding ambulatory conditions. In analysing the responses of prescribing pharmacists and physicians in Alberta to an online survey of 8 common ambulatory conditions, there was no significant differences between pharmacist and physicians in terms of diagnostic and therapeutic scores as well as in self-reported confidence in diagnostic and therapeutic choices. Based on this sample, there is evidence to demonstrate that prescribing

pharmacists in Alberta can appropriately manage and treat common ambulatory conditions consistent with family physicians. These results indicate despite concerns raised in the literature, prescribing pharmacists can respond to common ambulatory cases and provide safe and effective care. These findings should provide patients and healthcare providers evidence that prescribing pharmacists can be effective and valuable resources for clinical assessment regarding ambulatory conditions, which should help alleviate some pressure overworked physicians in a complicated healthcare system. Given the paucity of research associated with clinical reasoning and clinical decision making in prescribing pharmacists, this exploratory work demonstrates the first baseline evidence regarding the performance of prescribing pharmacists regarding the assessment of a variety of conditions. While several limitations exist within the methodology used in the study, such a small sample size, this study provides a unique finding that adds to research regarding clinical reasoning and clinical decision-making in pharmacy practice. Future directions using the findings of this study can look at the further development of prescribing pharmacist assessment as well as the role of collaborative prescribing partnerships amongst pharmacists and physicians.

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