Factors Shaping Pharmacists' Adoption of Prescribing in Alberta

by

Chowdhury Farhana Faruquee

A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in

Pharmacy Practice

Faculty of Pharmacy and Pharmaceutical Sciences

University of Alberta

Abstract

Canadian pharmacists received prescribing authority in 2007 and at present, Albertan pharmacists have the broadest scope of practice in the North America. The expanded scope of practice including prescribing activities was warranted to improve healthcare services. There have been noteworthy discussions in the literature on pharmacist prescribing. However, existing literature were predominantly focused on the outcome of pharmacist prescribing and stakeholders' perception about pharmacist prescribing in Canada. Little was known about the diffusion and adoption process of prescribing into the pharmacy practice. Therefore, the overarching objective of this thesis was to understand pharmacists' adoption of prescribing in Alberta by applying Diffusion of Innovation (DoI) theory. To achieve this objective, we developed a conceptual model using DoI, Self-efficacy, Role belief, and Relational coordination theories and conducted five studies: 1) A scoping review to characterize existing literature on pharmacist prescribing in Canada according to research type, methodological trend, and key findings; 2) Development of a survey questionnaire to explore pharmacist prescribing adoption and establishment of the psychometric validity of the scales using factor analysis; 3) Characterizing pharmacists according to their self-reported prescribing practice using cluster analysis; 4) Exploring factors predicting pharmacist prescribing frequency and types using regression analysis; and 5) Family physicians' experiences and perceptions of pharmacist prescribing using the Interpretive Description method.

In the scoping review, we found that quantitative studies were mostly focused on measuring the outcome of pharmacist prescribing whereas; qualitative studies explored stakeholders' perceptions. The review also suggested gaps in the evaluation of pharmacist prescribing

adoption, impact on physicians' practice, comparison of prescribing practice across provinces, and its impact on the economic system. In the second study, we developed a survey questionnaire and established the validity of five scales measuring potential predictors of pharmacist prescribing adoption – self-efficacy, prescribing belief, support from practice, impact on practice, and use of the Electronic Health Record (EHR). In the third study, we ran a secondary analysis of the survey data by applying cluster analysis and identified three major types of prescriber- "Renewal prescriber," "Modifier", and "Wide ranged prescriber". The group comparisons confirmed the expected characteristics of the groups and provided evidence of the validity of the groups. In the fourth study, on exploring factors predicting pharmacist prescribing adoption, we identified practice setting, support from practice, self-efficacy, and year of experience as the significant predictors of pharmacist prescribing frequency. On the other hand, pharmacists' practice setting and self-efficacy toward prescribing were significantly associated with the types of pharmacist prescribing adoption. In the fifth study, the qualitative exploration of family physicians' experience and perception provided us insight on physician-pharmacist collaboration while pharmacists are adopting prescribing activities. We found three key beliefs (i.e., renewal versus initiating new prescription, community versus team pharmacist, and "I am responsible") that shaped the physician-pharmacist prescriber collaboration. Two themes emerged from the analysis of collaboration process- trust and communication. We also found gaps in awareness and communication strategies to foster collaboration.

The overall findings of this thesis suggest that features of practice setting, pharmacists' attributes, and interprofessional collaboration with physicians shaped the pharmacist prescribing adoption in Alberta. Other jurisdictions that are planning to authorize pharmacist prescribing can reflect on our findings. Pharmacy researchers, policy-makers, and pharmacists themselves can

play key roles in the successful adoption of pharmacist prescribing and improve the efficiency of health care system. Future research might evaluate the change in healthcare delivery system resulting from pharmacist prescribing as well as alterations in the relational dynamics between physician and pharmacist prescribers.

Preface

This thesis is an original work by Chowdhury Farhana Faruquee. The research projects, of which this thesis is a part, received research ethics approval from the Health Research Ethics Board, University of Alberta, Project Name "Exploring pharmacists' new role in Alberta", No. Pro00036499, January 09, 2013 and Project Name "Exploring physicians' perceptions of pharmacist prescribing in Alberta", No. Pro00049902, August 05, 2014

Chapter Two of this thesis has been previously published as Faruquee CF, Guirguis LM. A scoping review of research on the prescribing practice of Canadian pharmacists. *Can Pharm J.* 2015;148(6):325-48. (Appendix 2) I was responsible for the data collection, analysis, and manuscript preparation. Dr. Lisa Guirguis was the corresponding author and was involved in the concept formation and contributed to manuscript edits.

Questionnaire development process in chapter three of this thesis was conducted by the research team (i.e. Dr. Christine A Hughes, Dr. Mark J Makowsky, Dr. Cheryl A Sadowski, Theresa J Schindel, Dr. Nese Yuksel) led by Dr. Lisa Guirguis at the University of Alberta. My contribution to this study was running exploratory factor analysis to establish scales' validity and reliability. I contributed to the manuscript writing in the methods and results sections to describe my part of research work. Research concept, data analysis, and writing manuscripts were done by me in chapter four and five. The study described in chapter six was conceptualized by me in collaboration with Dr. Amandeep S Khera, Assistant Professor, Department of Family Medicine, Misericordia Hospital, Edmonton. I was responsible for the data collection, analysis, and manuscript preparation. Dr. Lisa Guiguis was the supervisor research partner and was involved in the conceptualization of the study, data analysis, and manuscript composition.

Dedication

I dedicate this thesis dissertation to my parents and son. A special gratitude to my mother, Ashrafi Akhtun Chowdhury and my father, Mohammad Golam Farruque Chowdhury for believing in me and supporting me throughout my life. I also dedicate this work to the wonderful gift of my life, my son, Fayyad Ferdous Aayan for being there patiently with me during the entire doctoral program.

Acknowledgement

I wish to express the deepest gratitude to my supervisor Dr. Lisa Guirguis for accepting me as her PhD student at the first point and being generous with her expertise, guidance, care, and precious time all the way through my doctoral program. I also thank her for identifying my needs of improvement and providing support accordingly. Special thanks to Dr. Ken Cor and Dr. Mark Makowsky for being my committee members along with their constructive suggestions and valuable supports. I would also like to thank Dr. Amandeep Sheny Khera for her valuable contributions, and guidance in this research.

I am grateful to my family members in Bangladesh for their supports and prayers during the years. My immense gratitude goes to my mother, Ashrafi Akhtun Chowdhury, who taught me to never give up; My father, Mohammad Golam Farruque Chowdhury, who put his faith on me and my capability; my brother, Mohammad Asif Chowdhury, and sister in law, Farhia Silvana Haque who always encouraged me in pursuing my degree. I would also like to acknowledge incredible supports from my friends in Edmonton, Samprita Chakraborty, Dhrupad Debnath, Shara Khan, Laila Manzoor, Taslima Anwar, and Gita Chakraborty. Thanks for being my family away from home.

This acknowledgment will be incomplete without mentioning my husband, Faisol Ferdous, who made me stronger day by day and supported me; and my only son, Fayyad Ferdous Aayan, for his patience, understanding, and inspiration. You are my best cheerleader.

Lastly, and the most of all, I would like to thank Allah, the Almighty, who opened up opportunities for me and enabled me to accomplish this research work.

Table of Contents

List of Figures

List of Tables

Chapter One

Introduction

1.1 Background

Canada is experiencing population shift as baby boomers age and this is resulting in increased demand for healthcare service, and growth in the healthcare expenditure. Canada spends 45% of all public-sector health care funds on seniors (i.e. age 65 and over) who comprise 15% of the Canadian population.(1) Three-quarters of this senior group have at least one chronic disease.(2) This elevated demand for health service accounts for additional physician consultations, nurse assistants, medication uses, hospital services, and pharmacist supports. However, there is a low physician to population ratio of 2.28 physicians per 1,000 populations (i.e. ranks 28 out of 35 developed nations), and an imbalance in urban-rural (i.e. <10% in physician practice in a rural area) and family physicians-specialists distribution in Canada. (3) Similar scenarios are prevailing in other regulated countries, such as, the United Kingdom (UK), the United States (US), New Zealand (NZ), and Japan.(4) Considering the elderly population, unequal distribution of physicians, increased healthcare cost, and problematic chronic disease management, healthcare policies warranted expanded scope of practice and non-medical prescribing for other healthcare providers so that they can use their expertise to address the increased demand for healthcare services.

1.2 Emergence of non-medical prescribing and pharmacist prescribing

Non-medical prescribing is prescribing done by healthcare professionals other than physicians within their level of competency and expertise. It was first conceptualized in England in 1986 with proposing the idea of nurse prescribing.(5) In 1994, independent nurse prescribing from a

nurse prescribers' formulary (NPF) was sanctioned in several pilot sites in England, and eventually, the success of the pilot project enabled expansion to all nurses in England in 2001.(6) In 2003, further changes in policy approved supplementary prescribing by appropriately trained nurses and pharmacists which allowed them to prescribe under the supervision of physicians.(6) Physiotherapists, chiropodists/podiatrists, radiographers, and optometrists received similar prescribing authority in 2005.(6) Legislation approved independent prescribing for both nurses and pharmacists in 2006.(6)

Pharmacist prescribing used to exist even before the legislative approval in England. In the United States, pharmacist prescribing has been part of collaborative drug therapy management (CDTM) since 1979 and pharmacists were allowed to provide optimal drug therapy within the delegated authority by physicians.(7) As a part of CDTM, pharmacists may order laboratory tests, assess patients, initiate and modify drug therapy, monitor patients, and administer drugs.(8) The level of authority varies in each state's CDTM legislation, which is evolving over time. Pharmacists in New Zealand are also involved in collaborative prescribing.(9) Australian pharmacists can prescribe schedule 2 and schedule 3 medicines. (10) Schedule 2 medicines (e.g. dextromethorphan, simple analgesic, non-sedative anti-histamine, nasal spray containing steroids) are generally considered safe and used to treat minor ailments. Pharmacists are allowed to provide these medications to the patients.(10) Schedule 3 medicines (e.g. Orlistat, Pseudoephedrine, Salbutamol) are known as pharmacist-only medicines because even though these drugs are safe pharmacists' advice and follow-up are required to purchase these drugs.(10) Pharmacists are also allowed to extend a prescription provided by an authorized prescriber up to one year.(10)

1.3 Pharmacist prescribing in Canada

In the last 10 years, provinces in Canada have introduced different policies regarding the extended scope of pharmacy practice, especially focused on prescribing activities.(11) As pharmacists' scope of practice falls under provincial jurisdiction, prescribing authorities vary across Canada. (Figure 1.1) These policies authorized pharmacists to practice following prescribing related activities.

1.3.1 Prescribing for minor ailments

Pharmacists can prescribe over-the-counter and prescription drugs with wide safety margins to treat minor, self-diagnosed or self-limiting disease conditions. Lab tests and long-term follow-ups are not required to prescribe. (12) Pharmacists are prescribing for minor ailment and smoking cessation in all provinces except two provinces (i.e., Ontario and British Columbia).(13)

1.3.2 Emergency prescribing

Pharmacists can provide emergency supplies of prescribed medication to a patient. Pharmacists can prescribe to treat symptoms when there is an instant necessity of drug therapy and another primary prescriber is unavailable. (14) In six out of ten provinces (i.e., Alberta, Saskatchewan, Manitoba, New Brunswick, Nova Scotia, and Prince Edward Island) pharmacists are prescribing in emergency conditions when the patient has no other access to medical care but require immediate attention.(13)

1.3.3 Renewing prescription

Pharmacists can monitor and authorize the refill of existing prescriptions to ensure appropriate and effective care. (14) Pharmacists of all the ten provinces and one territory (i.e., Northwest

Territory) can renew or extend prescription for continuity up to different periods according to the provincial regulations.(13)

1.3.4 Prescription alteration

Pharmacists can modify or adapt a new prescription written by another prescriber to alter dosage, formulation, regimen or duration of the prescribed drug.(14) Pharmacists in all provinces are allowed to adapt a prescription by changing the dosage, formulation or regimen if needed.(13)

1.3.5 Therapeutic substitution

Pharmacists can substitute a new prescription written by another prescriber to provide similar therapeutic effect with improved drug therapy. (14) Pharmacists can make therapeutic substitutions in all the provinces except three (i.e., Ontario, Manitoba, and Quebec) in collaborative practice agreement or independently.(13)

1.3.6 Initiating new prescription

Pharmacist with special authorization can initiate new drug therapy based on their own assessment of the patient or in collaboration with another authorized prescriber or in cooperation with a non-authorized health care professional.(14) Pharmacists are allowed to initiate new prescription collaboratively in five out of ten provinces (i.e., Alberta, Saskatchewan, Manitoba, New Brunswick, and Nova Scotia).(13) Only Albertan pharmacists with Additional Prescribing Authority (APA)can initiate new prescription independently.(13)

In three provinces (i.e., Alberta, Manitoba, and Quebec), pharmacists are also allowed to order and interpret lab tests as a part of their assessment and monitoring of the patient.(13,14) Pharmacists are also authorized to administer vaccines in the all provinces excluding Quebec and

they are also able to administer injection of any drug except narcotic and controlled ones in the all provinces except British Columbia, Ontario, Quebec, and Nova Scotia.(13)

In Canada, pharmacist prescribing is guided by several professional components. Pharmacists must maintain independence and professional relationship with both patients and other healthcare providers. Pharmacist prescribing should be in the patient's best interest and not for their (i.e., Pharmacists') own family members. Pharmacists need to have competence and sufficient clinical knowledge as well as practice evidence-based prescribing for approved indications. (15) Prescribing decisions and their rationale should be documented and conveyed to other health care professionals involved in patient's care. (15)

Alberta was the first jurisdiction in Canada, to authorize pharmacist prescribing.(16) Albertan pharmacists acquired this approval in 2007 under several timely and positive influences which included re-designation for all healthcare providers regarding scope of practice in the Health Professions Act, support from the Alberta College of Pharmacists (ACP), a strong platform of pharmacists' knowledge and skill supported by the pharmacy education program, independent research support, healthcare providers' collaboration, and a requirement for timely and fair access to health care services.(17) Pharmacists in Alberta are authorized to carry out prescribing schedule 1 drugs, except narcotic and controlled drug (i.e., opioids and its derivatives, barbiturates, and benzodiazepines).(16) They are involved in altering dose, substituting a drug within the same therapeutic class, prescribing for continuation of therapy and prescribing in emergency conditions. Pharmacists with APA can initiate new prescription independently or in collaboration with another health care provider after appropriate assessment within their limit of competency at the point of access.(16) To receive this special authorization of prescribing, pharmacists have to submit a comprehensive application package to the ACP providing evidence

of quality patient care.(18) Additionally, Albertan pharmacists are authorized to inject vaccines, schedule one drugs with prior training and order and interpret lab test for the patients. Pharmacists in Alberta have broadest scope of practice in Canada at present.(13) (Figure 1.1)

1.4 Literature on pharmacist prescribing and gap

In Canada, researchers have focused on different areas of pharmacist prescribing to examine and explore, such as, the consequences of pharmacist prescribing, perceptions of different stakeholders, evolution of pharmacy practice, and changes in regulation. (19) The majority of the studies focused on measuring outcomes of pharmacist prescribing and showed positive clinical outcomes of pharmacist prescribing in terms of chronic disease management, reducing blood pressure, symptomatic improvement, quality of medication use, quality of life and cost, effectiveness.(20-33) Renewing prescriptions by pharmacists reduced ambulatory physician visits before the renewal, but there was also increase in visits after the dispensing.(34) Literature on pharmacist prescribing in the UK and US provides a slightly different story. There is limited international research on the clinical outcome of pharmacist, prescribing and those studies provide evidence of improved quality of patient care such as extended patient consultation time, reduced waiting time, and better patient education.(35-37)

Although no negative outcome was reported in the literature, contradictory perceptions and concerns about patient safety were found in Canada.(38-48) The general public tentatively supported an expanded role for pharmacists in tasks familiar to patients, such as continuing ongoing medication therapy. (38). Governments and pharmacists exhibited immense support of prescribing to improve patients' access to medications (43) Still, the literature suggests that the general public and physicians have a low level of understanding and beliefs about expanded role for pharmacists. (38, 42) In the UK and Australia patients supported prescribing by physician

after initial diagnosis and complex situations.(10,37) Physicians in the both UK and US reported pharmacist prescribing reduced their workload and allowed them to concentrate on more specialized tasks.(36,49) But physicians in the UK showed less favour for independent pharmacist prescribing and their major concern is pharmacists' lack of training related to diagnosis.(35, 50)

The complexity of practice, evolving around pharmacist prescribing, has been explored in research related to practice change. The uptake of some prescribing activity is low in Canada. (34,51) Literature has suggested that practice setting, liabilities, efficiency, workload, interprofessional acceptability and collaboration, and application processing time are all influencing factors.(51-54) In the UK, community pharmacists reported inadequate access to patient records, insufficient staffing, and lack of support and collaboration from general practitioners as hurdles for embracing prescribing into practice, which led to three times less adoption of prescribing in community pharmacies compared to hospitals.(55) On the contrary, the UK literature suggests, chronic diseases, such as hypertension, could be better managed when community pharmacists and general practitioners work collaboratively.(56) But this collaboration is being hindered due to lack of a suitable communication system between community pharmacists and general practitioners.(56)

However, there was lack of summary of research on pharmacist prescribing in Canada as well as little was known about pharmacists' prescribing adoption level and other healthcare professionals' experience and awareness about pharmacist prescribing practice.

1.5 Objectives

The broad intent of this thesis was to understand pharmacist prescribing adoption and its impact on physicians' practice in Alberta. Following were the main objectives of this thesis:

1. To explore the factors those have impacted Albertan pharmacists' frequency and types of prescribing adoption. (Quantitative study)
2. To explore Albertan family physicians' perceptions and experiences of pharmacist prescribing. (Qualitative study)

1.6 Conceptual framework

As adoption of new behaviors is complex, we used "Diffusion of Innovation" (DoI) as an overarching theory for this thesis. As DoI theory explains the process of adoption of an innovation or a new practice or behaviour (57), it is useful to describe the uptake of prescribing practice by pharmacists. Greenhalgh's model illustrated eight features of diffusion of innovation- the innovation, the adopters, system antecedents, system readiness, communication and influence, the outer context, the implementation process, and linkage between design stage and implementation stage.(58) We used four features of DoI theory (i.e. the innovation, the adopters, system readiness, and communication and influence) in application of this model to the quantitative study. Due to absence of the external or organizational lens in our survey data collection procedures we excluded the rest of the four features. In the quantitative research, we used "Self–Efficacy" theory (59) and "Role Belief" theory (60) for further elucidating pharmacists' beliefs as a part of the DoI theory. However, we designed our qualitative study to explore the integrative organizational network and collaboration aspects of the "outer context" feature of the DoI theory. We also employed "Relational Coordination theory"(61) to understand the physicians-pharmacists' relational dynamics from physicians' perception of pharmacist prescribing in the qualitative study. This qualitative study characterised factors from the outer context (i.e. physicians' perceptions and experiences) that may have impacted pharmacist prescribing adoption.(62) (Figure 1.2)

1.7 Dissertation outline

We conducted five studies to meet the main objectives of the thesis. First, we conducted a scoping review to characterize the literature on prescribing by pharmacists in Canada according to methodological trends, research areas and key findings (Chapter 2). This study facilitated us in identifying gaps in existing literature regarding pharmacist prescribing adoption. The second study (Chapter 3) was conducted to establish the evidence of validity and reliability of the scales measuring variables those might affect pharmacist prescribing in Alberta. Chapter three described the development process of the survey questionnaire and my contribution to this study was the establishment of the initial psychometric properties of the survey instrument. We used exploratory factor analysis to establish convergent validity and reliability of the scales. We used these scales as factors to predict pharmacist prescribing adoption in the fourth study. Descriptive analysis of the survey results were previously published.(63) In the third study (Chapter 4), we used cluster analysis to characterize Albertan pharmacists into different groups according to their types of prescribing practice by conducting a secondary analysis of a survey data in Chapter 3.. This study grouped pharmacist prescribers according to their prescribing behaviors. In the fourth study (Chapter 5), we conducted a secondary analysis using hierarchical multiple regression and sequential logistic regression analysis of the survey data to examine the factors that have impacted Albertan pharmacists' frequency and types of prescribing adoption. The fifth study (Chapter 6) was a qualitative exploration of Albertan family physicians' experiences and perceptions of pharmacist prescribing using interpretive description methodology. This study elucidated the impact of pharmacist prescribing adoption on the physicians' practice and provided us insight on strategies to improve pharmacist prescribing adoption while collaborating with physicians.

1.8 References

1. National Health Expenditure Trends, 1975 to 2014. National Health Expenditure Database, Canadian Institute for Health Information. [Updated 2014; cited 2017 May 20]. Available from: https://www.cihi.ca/en/nhex_2014_report_en.pdf
2. Terner M, Reason B, McKeag AM, Tipper B, Webster G. Chronic conditions more than age drive health system use in Canadian seniors. *Healthc Q.* 2011; 14(3):19-22.
3. Canadian Collaborative Centre for Physician Resources. Canadian Physician Resources – 2017 Basic Facts. Canadian Medical Association; 2017. [Updated 2017 March; cited 2017 May 20]. Available from: https://www.cma.ca/En/Pages/basic-physician-facts.aspx
4. OECD (Organization for Economic Co-operation and Development) Health Statistics 2014. [Updated 2014 November; cited 2017 May 20]. Available from: http://www.oecd.org/els/health-systems/oecd-health-statistics-2014-frequently-requested-data.htm
5. Britain G, Cumberlege J. Neighbourhood Nursing: a focus for care. HM Stationery Office; 1986.
6. Cooper R, Guillaume L, Avery T, Anderson C, Bissell P, Hutchinson A, et al. Nonmedical prescribing in the United Kingdom: developments and stakeholder interests. *J Ambulatory Care Manage*. 2008;31(3):244-52.
7. McBane SE, Dopp Al, Abe A, Benavides S, Chester EA, Dixon DL, et al. Collaborative Drug Therapy Management and Comprehensive Medication Management. *Pharmacotherapy.* 2015;35(4):e39–e50

8. Hammond RW, Schwartz AH, Campbell MJ, Remington TL, Chuck S, Blair MM, et al. Collaborative Drug Therapy Management by Pharmacists. *Pharmacotherapy,* 2003;23(9):1210-1225

9. Pharmacist Prescriber Scope of Practice, Pharmacy Council of New Zealand 2013. [updated 2013 April; cited 2017 May 20]. Available from: http://www.pharmacycouncil.org.nz/Portals/12/Documents/prescribers/NZ%20Pharmacist%20Prescriber%20Scope%20of%20Practice%20FINAL.pdf?ver=2017-02-20-125642-553

10. Hoti K, Hughes J, Sunderland B. An expanded prescribing role for pharmacists-an Australian perspective. *Australas Med J.* 2011;4(4):236-242.

11. Emmerton L, Marriott J, Bessell T, Nissen L, Dean L. Pharmacists and prescribing rights: Review of international developments. *J Pharm Pharm Sci.* 2005;8(2):217-225.

12. Guidelines for Minor Ailment Prescribing, University of Saskachewan. [Updated 2017 May 01; cited 2017 May 25]. Available from: https://medsask.usask.ca/professional/guidelines/

13. Pharmacists' Expanded Scope of Practice in Canada, Canadian Pharmacists Association. [Updated 2016 Dec; cited 2017 May 25]. Available from: http://www.pharmacists.ca/index.cfm/pharmacy-in-canada/scope-of-practice-canada/

14. Position Statement on Pharmacist Prescribing, Canadian Pharmacists Association. [Updated 2011 Oct; cited 2017 May 27]. Available from: http://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/PPPharmacistPrescribing.pdf

15. The health professional's guide to pharmacist prescribing: Alberta College of Pharmacists. [Updated 2012 Sep; cited 2017 May 25]. Available from: https://pharmacists.ab.ca/sites/default/files/HPGuidePrescribing.pdf
16. Yuksel N, Eberhart G, Bungard TJ: Prescribing by pharmacists in Alberta. *Am J Health Syst Pharm.* 2008; 65(22):2126–2132.
17. 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.
18. Guide to receiving Additional Prescribing Authorization, Alberta College of Pharmacists, 2nd Edition. [Updated 2013 Jan; cited 2017 May 25]. Available from: https://pharmacists.ab.ca/sites/default/files/APAGuide.pdf
19. Faruquee CF, Guirguis LM. A scoping review of research on the prescribing practice of Canadian pharmacists. *Can Pharm J (Ott).* 2015; 148(6):325-348
20. Mansell K, Bootsman N, Kuntz A, Taylor J. Evaluating pharmacist prescribing for minor ailments. *Int J Pharm Pract.* 2015; 23(2):95-101
21. Al Hamarneh YN, Charrois T, Lewanczuk R, Tsuyuki RT. Pharmacist intervention for glycemic control in the community (the RxING study). *BMJ* Open. 2013 Sep;3:e003154
22. Law MR, Morgan SG, Majumdar SR, Lynd LD, Marra CA. Effects of prescription adaptation by pharmacists. *BMC Health Serv Res.* 2010;10(1):313.
23. Charrois TL, McAlister FA, Cooney D, Lewanczuk R, Kolber MR, Campbell NR, et al. Improving hypertension management through pharmacist prescribing; The rural Alberta clinical trial in optimizing hypertension (Rural RxACTION): Trial design and methods. *Implement Sci.* 2011;6(1):94

24. McAlister FA, Majumdar SR, Padwal RS, Fradette M, Thompson A, Buck B, et al. Case management for blood pressure and lipid level control after minor stroke: PREVENTION randomized controlled trial. *CMAJ*. 2014;186(8):577-84.
25. Tsuyuki R, Houle S, Charrois TL, Kolber MR, Rosenthal MM, Lewanczuk R, et al. A 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: 93-100
26. 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):283-92.
27. Al Hamarneh Y, Tsuyuki R, Hemmelgarn B, Jones C, Oladele D. The design of the Alberta Vascular Risk Reduction Community Pharmacy Project: RxEACH. *Can Pharm J (Ott)*. 2014;147(Suppl 1):S46.
28. McKinnon A, Jorgenson D. Pharmacist and physician collaborative prescribing: For medication renewals within a primary health centre. *Can Fam Phys.* 2009;55(12):e86-e91.
29. Soon J, Leung V, Smith A, Shoveller J. Temporal and regional differences in emergency contraception use: A population-based analysis. *Contraception.* 2011;84(3):327.
30. Houle SK, Charrois TL, McAlister FA, Kolber MR, Rosenthal MM, Lewanczuk R, et al. Pay-for-performance remuneration for pharmacist prescribers' management of hypertension: A substudy of the RxACTION trial. *Can Pharm J (Ott)*. 2016;149(6):345-51.

31. Al HamarnehY, Sauriol L, Tsuyuki R. Economic analysis of the RxING study. *Can Pharm J (Ott).* 2014;147(4):S47

32. Lyster RL, Houle SK. Abnormal vaginal bleeding following pharmacist prescribing of metformin leads to the detection of complex endometrial hyperplasia. *Ann Pharmacother.* 2013; 47(11):1581-1583.

33. Tsuyuki RT, Houle SKD, Charrois TL, Kolber MR, Rosenthal MM, Lewanczuk R, et al. A 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

34. Law MR, Cheng L, Kratzer J, Morgan, Marra C, Lynd LD,et al. Impact of allowing pharmacists to independently renew prescriptions: A population-based study. *J Am Pharm Assoc.* 2015;55(4):398–404.

35. Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int J Pham Pract.* 2009; 17(2): 89-94.

36. Woolfrey S, Dean C, Hall H, Hospital pharmacist prescribing: a pilot study. *Pharm J.* 2000; 265 (7105):97-99

37. McCann LM, Haughey SL, Parsons C, Lloyd F, Crealey G, Gormley GJ, et al. A patient perspective of pharmacist prescribing: 'crossing the specialisms-crossing the illnesses'. *Health Expect.* 2015; 18(1):58-68.

38. Perepelkin J. Public opinion of pharmacists and pharmacist prescribing. *Can Pharm J (Ott).* 2011;144(2):86-93.

39. Hughes CA, Makowsky MJ, Sadowski CA, Schindel TJ, Yuksel N, Guirguis LM. What prescribing means to pharmacists: a qualitative exploration of practicing pharmacists in Alberta. *Int J Pharm Pract.* 2014; 22(4):283-291.

40. Charrois TL, Rosenthal M, Hoti K, Hughes C. Pharmacy Student Perceptions of Pharmacist Prescribing: A Comparison Study. *Pharmacy.* 2013;1(2):237-247.

41. Grindrod KA, Lynd LD, Joshi P, Rosenthal MM, Isakovic A, Marra CA. Pharmacy Owner and Manager Perceptions of Pharmacy Adaptation Services in British Columbia. *Can Pharm J (Ott).* 2011; 144(5):231-235.

42. Henrich N, Joshi P, Grindrod KA, Lynd LD, Marra CA. Family Physicians' Perceptions of Pharmacy Adaptation Services in British Columbia. *Can Pharm J (Ott).* 2011; 144(4):172-178.

43. Pojskic N, MacKeigan L, Boon H, Austin Z. Initial perceptions of key stakeholders in Ontario regarding independent prescriptive authority for pharmacists. *Res Social Adm Pharm.* 2014; 10(2):341-354.

44. Schindel TJ, Given LM. The pharmacist as prescriber: A discourse analysis of newspaper media in Canada. *Res Social Adm Pharm.* 2013; 9(4):384-395.

45. Guirguis LM, Cooney D, Dolovich L, Eberhart G, Hughes C, Makowsky M, et al. Exploring pharmacists' understanding and adoption of prescribing in 2 Canadian jurisdictions: Design and rationale for a mixed-methods approach. *Can Pharm J (Ott).* 2011; 144(5):240-244.

46. Norman WV, Wong M, Soon J, Zed P. DO rural pharmacists in British Columbia find independent prescribing of hormonal contraceptives feasible and acceptable? The “act-pharm” study. *Contraception.* 2013;88(3):451-452.

47. Bishop AC, Boyle TA, Morrison B, Zwicker B, Mahaffey T, Murphy A. Public attitudes towards the expanded scope of pharmacy practice in Nova Scotia. *Can Pharm J (Ott)*. 2015;148(5):274-283

48. Donald M, King-Shier K, Tsuyuki RT, Al Hamarneh YN, Jones CA, Manns B, et al. Patient, family physician and community pharmacist perspectives on expanded pharmacy scope of practice: a qualitative study, *CMAJ Open.* 2017;5(1),E205-E212

49. Blenkinsopp A, Tann J, Evans A, Grime J. Opportunity or threat? General practitioner perceptions of pharmacist prescribing. *Int J Pham Pract.* 2008;16(1):29-34.

50. Lloyd F, Hughes CM. Pharmacists' and mentors' views on the introduction of pharmacist supplementary prescribing: a qualitative evaluation of views and context. *Int J Pham Pract.* 2007;15(1):31-37

51. Hutchison M, Lindblad A, Guirguis LM, Cooney D, Rodway M. Survey of Alberta hospital pharmacists' perspectives on additional prescribing authorization. *Am J Health-Syst Pharm.* 2012; 69(22):1983-1992.

52. Guirguis LM, Makowsky MJ, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N. How have pharmacists in different practice settings integrated prescribing privileges into practice in Alberta? A qualitative exploration. *J Clin Pharm Ther.* 2014;39(4):390-98.

53. Charrois T, Rosenthal M, Tsuyuki R. Stories from the trenches: Experiences of Alberta pharmacists in obtaining additional prescribing authority. *Can Pharm J (Ott).* 2012;145(1):30-34.

54. Guirguis L, Dolovich L, Hughes C, Makowsky MJ, Sadowski CA, Schindel TJ, et al. Pharmacists' perceptions of prescribing in two Canadian jurisdictions. *Can Pharm J (Ott).* 2014;147(4):S21

55. George J, McCaig DJ, Bond CM, Cunningham IT, Diack HL, Watson AM, et al. Supplementary prescribing: Early experiences of pharmacists in Great Britain. *Ann Pharmacother.* 2006; 40(10):1843-50.

56. West R, Isom M. Management of patients with hypertension: general practice and community pharmacy working together. *Br J Gen Pract.* 2014; 64(626): 477–478.

57. Rogers EM. Diffusion of Innovations: Fourth ed. New York: The Free Press; 1995.

58. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: systematic review and recommendations. *Milbank Q.* 2004, 82(4):581–629.

59. Bandura A. Self-efficacy: The exercise of control. New York: W.H. Freeman.1997

60. Biddle B. Recent developments in role theory. *Annu Revi Sociol.* 1986; 12(1): 67-92.

61. Gittell JH. Relationships between service providers and their impact on customers. *J Serv Res.* 2002; 4(4): 299-311.

62. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Yuksel N. Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. *Implement Sci.* 2013; 14;8:109-5908-8-109.

63. Guirguis LM, Hughes CA, Makowsky M, Sadowski C, Schindel T, Yuksel N. Survey of Pharmacist Prescribing Practices in Alberta. *Am J Health-Syst Ph*. 2017;74(2):62-69

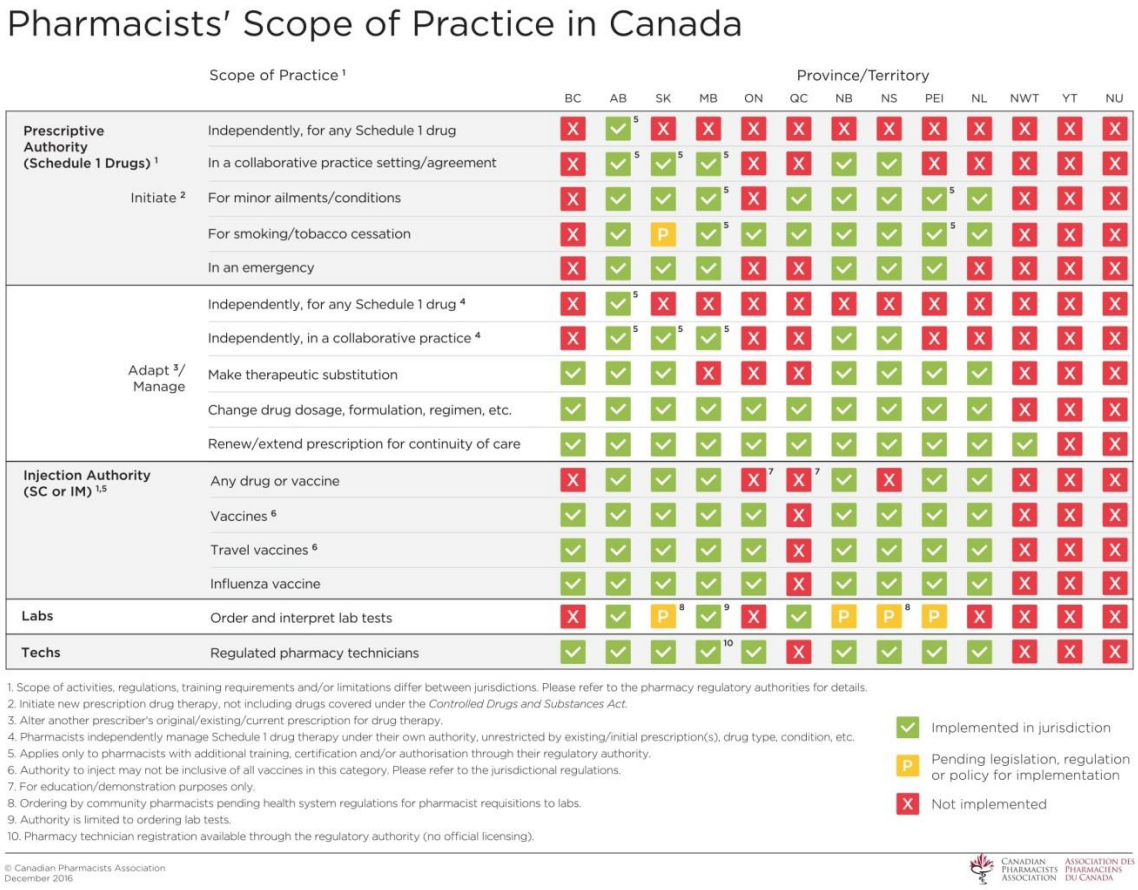

Figure 1.1 Pharmacists' scope of practice in Canada

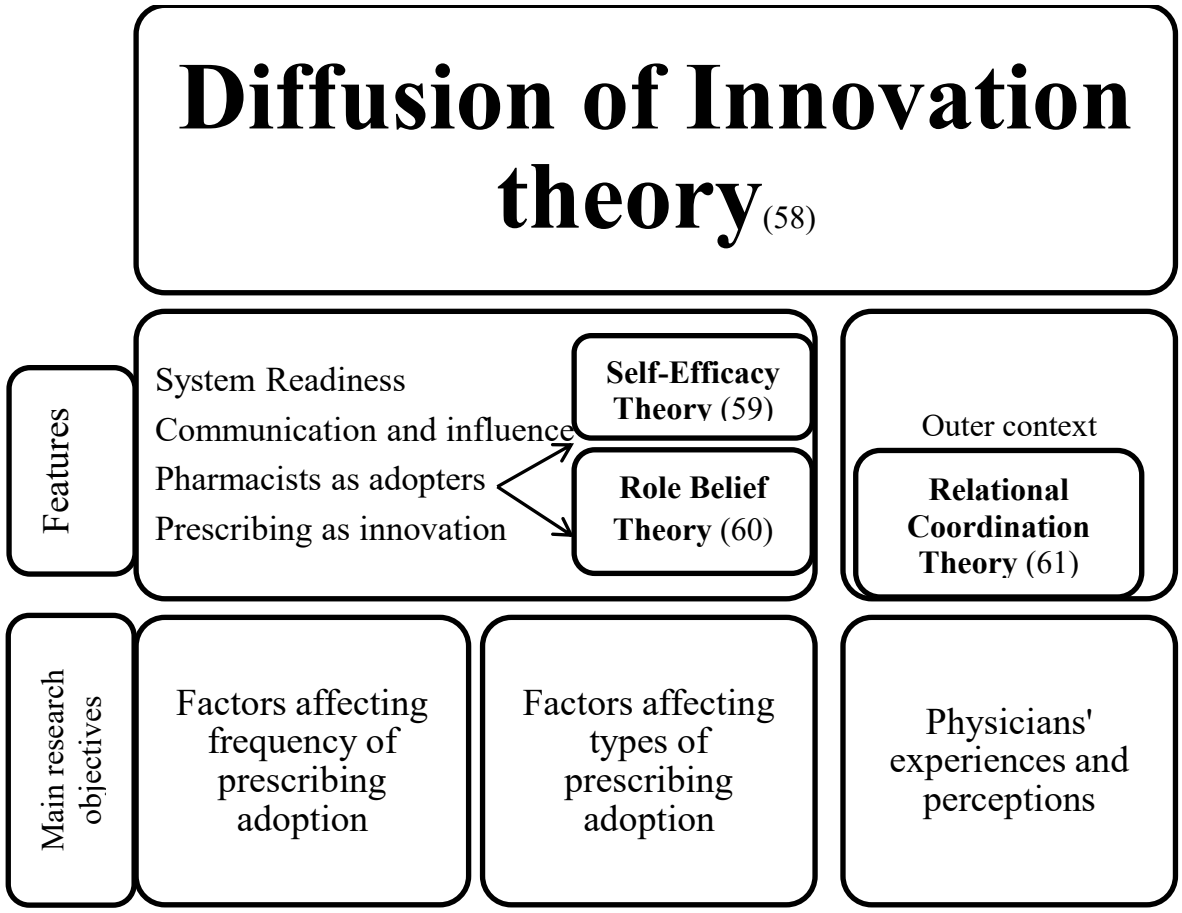

Figure 1.2 Conceptual framework of dissertation research

Chapter Two

A scoping review of research on the prescribing practice of Canadian pharmacists

Chowdhury F Faruquee, Lisa M Guirguis

A version of this chapter has been published in the Canadian Pharmacists Journal

Faruquee CF, Guirguis LM. A scoping review of research on the prescribing practice of Canadian pharmacists. *Can Pharm J*. 2015;148(6):325-48.

2.1 Abstract

Background: Pharmacists in Canada have been prescribing since 2007. The review aims to explore the volume, array and nature of research activity on Canadian pharmacist prescribing and to identify gaps in existing literature.

Method: We conducted a scoping review to examine the literature on prescribing by pharmacists in Canada according to methodological trend, research area, and key findings. We searched for peer-reviewed research articles and abstracts in Ovid Medline, Ovid EMBASE, and International Pharmaceutical Abstract (IPA) without any date limitation. A standardized form was used to extract information.

Results: We identified 167 articles, and 26 articles and 12 abstracts met inclusion criteria. Half of research studies (20) used quantitative methods including surveys, trials and experimental designs with; 11 studies used qualitative methods and seven used other methods including mixed methods, review articles, or case study. Predominate research areas included patient outcomes (13 studies), perceptions of prescribing (10) and practice change (11). Pharmacist prescribing was adopted when pharmacist practiced patient centred care and resulted in positive patient outcomes. Stakeholders held contrasting perceptions of pharmacist prescribing.

Discussion: Canadian research has demonstrated the benefits of pharmacist prescribing on patient outcomes which are not present in international literature. Future research may consider a meta-analysis addressing the impact on patient health. Gaps in research include comparisons between provinces, impact on physician's services, overall patients' access to the healthcare system, and safety and economic implications for society.

Conclusion: A growing body of research on pharmacist prescribing has captured the early impact of prescribing on patient outcomes and perceptions of practice. Opportunities exist for PAN-Canadian research examining the system impact.

2.2 Introduction

Pharmacists have training and expertise in medication therapy as well as patient care capabilities to assess and respond to patients' health care and drug-related needs. While pharmacists are often perceived as medication dispensers, their professional role goes well beyond this simplistic caricature. Pharmacists are important members of the healthcare team who have the skill and knowledge to initiate, monitor, and adjust drug therapy (1) and are well recognized by the general public as knowledgeable about medications (2). While medicine and dentistry professions dominate the prescribing activity, other health care professionals such as optometrists, podiatrists, midwives, and nurse practitioners have been granted prescribing rights.(3) Similarly, pharmacists' expanded professional role includes prescribing. Pharmacist prescribing is different from prescribing by other healthcare professionals. Pharmacists may alter or adapt a prescription, renew a prescription for continuity, provide an emergency supply, or initiate a new medication therapy (i.e., prescription and non-prescription therapies). (4)

The jurisdictive power of prescribing by pharmacists varies between countries. Internationally there are different models of pharmacists prescribing.(1,5) In the United Kingdom (UK), supplementary prescribing (i.e. prescribing authorities through different protocols, formularies) by the pharmacist was approved in 2003. Then in 2006, pharmacists obtained independent prescribing rights (i. e. prescribing personnel is solely responsible for the patient assessment, initiating therapy and clinical management).(1,5,6) In the United States (US) there are also two models of pharmacist prescribing. Over 41 US states allow dependent prescribing as a part of

Collaborative Drug Therapy Management (CDTM) and five states allow collaborative prescribing of controlled substances.(7-10) The independent prescribing model was first introduced in a Florida VA out-patient clinic.(9)

In contrast with the UK and USA, prescribing in Canada varies by jurisdiction. In the last seven years, provinces in Canada have introduced a number of differing policies regarding the extended scope of pharmacy practice especially focused on prescribing activities.(5) Pharmacists can independently prescribe in 7 out of 10 provinces. In Canada, independent prescribing includes extending existing prescriptions (10 provinces), adapting existing prescriptions (i.e., change of drug dosage and formulation in 9 provinces and therapeutic substitution in 7 provinces) and initiating new prescriptions (7 provinces).(11) In some provinces (Saskatchewan, Nova Scotia, and Prince Edward Island) initiating new prescriptions refers to pharmacist prescribing only as part of the assessment and prescribing for minor ailments. (11) In Alberta pharmacists with additional prescribing authority can prescribe prescription only drugs excluding narcotics and controlled substance based on initial assessment, or in collaboration with either another authorized prescriber or regulated health professionals with non-prescriptive authority. (4) There is variability in provincial and employer-sponsored reimbursement for patients for prescriptions written by a pharmacist.(10)

The objective of prescribing by the pharmacist is to make use of pharmacists' expertise and knowledge to improve the health of Canadians. Legislation and practice models are changing depending on the effect on patient care and patients' outcomes of prescribing by pharmacists.(5) There have been a noteworthy discussion in the literature about the benefits and problems of the expanded scope of pharmacists' practice in Canada.(5) For seven years, pharmacists have

performed many types of prescribing within Canada. Therefore, we aimed to review the empirical literature on pharmacist prescribing in Canada.

2.3 Objectives

The objective of this scoping review was to characterize the literature on prescribing by pharmacists in Canada according to methodological trends, research areas, and key findings.

2.4 Methods

2.4.1 Scoping review

We conducted a scoping review of the research on the prescriptive authority of Canadian pharmacists. The purpose of a scoping review is to give an overview of volume, array, and nature of research activity by mapping the available literature on a particular field of study.(12) Scoping reviews identify the gaps in existing literature but do not assess research quality.(12)

2.4.2 Search Strategy

The following three electronic databases were searched without any limitation of the date of publication: Ovid Medline, Ovid EMBASE and International Pharmaceutical Abstract (IPA). Key search terms included “Pharmacist prescribing,” “Prescribing by protocol or protocol-based prescribing,” “Collaborative prescribing,” “independent or supplementary prescribing,” “Adaptation of prescription,” and “Minor ailment prescribing.” They were combined with search terms related to Canadian or different provinces and territories of Canada. We used different terminologies as the context of pharmacist prescribing varies across Canada. For example, prescribing is called “expanded role” or “additional prescribing authority” in Alberta, “adaptation service” in British Columbia, and “minor ailment prescribing” in Saskatchewan, Manitoba and Nova Scotia.

A detailed search strategy is presented in Appendix 1. All searches were then exported to RefWorks, a reference manager software, and duplicates were removed. The search results are shown in Figure 1.

2.4.3 Study Selection

Studies were eligible for inclusion if they were related to prescribing activities of pharmacists in Canada and were published in English as peer-reviewed research articles or abstracts. The two authors screened each article in two stages independently. In the first stage, we reviewed titles and abstracts for potential relevance. In the second stage, we obtained full-text articles for further evaluation and examined to determine eligibility. We resolved any discrepancies regarding inclusion by discussion.

2.4.4 Data Synthesis

We used a standardized form to extract data from the selected studies and verified the data for accuracy and inclusiveness. The following study characteristics were recorded: lead author, year of publication, location, subject, method, analysis, results or key findings and research design. We categorized the literature according to methodological trend, research area, and key findings.(13) The guiding questions were as follows: “What data analysis techniques are most commonly used in research?” and “What is the range and frequency of topics being explored in research?” Initially, we organized the research by research methods: using inferential statistics, descriptive statistics and qualitative or combined data analysis methodologies. We were open to adding categories as required. We extracted and categorized all research questions to understand the breadth of ideas and themes. Then we compared the study topics to find similarities and clustered them into broader categories. We identified the gaps after analyzing the data and themes extracted from the existing literature.

2.5 Results

We identified 167 articles, excluding 127 articles after initial screening and two articles after full-text assessment for eligibility, resulting in 26 articles and 12 abstracts that met the inclusion criteria (Figure 1). These publications represent 35 datasets. Findings are summarized in tables organized by research areas (Table 1-5).

We found 20 quantitative studies, 11 qualitative studies, three mixed method studies, one case study, one observation and two document analyses. Quantitative manuscripts used surveys (8 studies) (2, 14-20), experiments (3 studies) (21-23), randomized control trials (5 studies) (24-28) and others (4 studies) (29-32). Qualitative studies explored perceptions of pharmacists (33) or pharmacy students (34)(2 studies), stakeholders (3 studies) (35-37), media (1 study) (38) and different factors influencing the practice change (5 studies). Two methodology papers describe the mixed method (semi-structured interview and survey) to explore pharmacists' perception about prescribing in Alberta, British Columbia, and Ontario.(44,45) Another mixed method study used online survey with both open-ended and 5 point scale questions to explore the public attitude towards the expanded role of pharmacists in Nova Scotia.(46) Two rich descriptions of regulatory changes summarized independent prescribing rights across Canada.(10,47) Finally, there was a case study (48) and description of higher education training of independent pharmacist.(49) Two studies collaborated with Australia (34) and Scotland (49).

2.5.1 Key Findings by Research area

By analyzing the topics for similarities and grouping them into broader categories we found five research areas: outcomes (13 studies), perceptions of prescribing (10), practice change (11), regulatory scan (2), and training (2).

First, 13 studies measured the "**outcome**" or impact of the pharmacist prescribing including clinical, medication use, and humanistic and economic outcomes. **(Table 2.1)**.(18, 22-32, 48) Three papers, evaluating the outcome of pharmacist prescribing on use of antihypertensive(24), cardiovascular risk reduction(28), and health care use(23), were on study design and did not report any result. All remaining studies reported the benefit of pharmacist prescribing. Seven studies showed benefit in clinical patient outcome. These studies found improved risk factor control in patients with prior stroke(25), reduced systolic blood pressure(SBP) (26,31) and LDL-c (27), improved glycemic control in poorly controlled type 2 diabetic patients(22), and improved quality of life in uncontrolled type 2 diabetes in a cost-effective manner (32). Not only better chronic disease management but also significant symptomatic improvement was reported by 81% patients while pharmacists prescribed for the minor ailment in Saskatchewan.(18) A case study found that pharmacist prescribing in collaboration with other healthcare professionals facilitated the detection of an underlying disease.(48) Two studies found pharmacist prescribing improved medication use with an increased drug-related problem identification(29) and increased use of emergency contraceptive pills.(30) Finally, one study showed benefit in humanistic and economic outcomes in terms of improved quality of life and cost-effectiveness when pharmacists initiated insulin therapy in uncontrolled type 2 diabetes. All of the studies used the quantitative method, except the case study. (18,22-32,48) Among 12 quantitative studies, five studies were randomized control trials. (24-28)

"**Perception**" or insight about pharmacist prescribing was evident in 10 studies **(Table 2.2)**. Researchers used different lenses such as public, students, government, physician and pharmacists themselves to understand the insight.(2, 33-38,44-46) The general public in Saskatchewan and Nova Scotia agreed with pharmacists prescribing in minor ailment

management (2, 46), emergency (2) and prescription renewal (46) but showed less support in diagnosing new diseases and prescribing a treatment plan(2). Pharmacy students and health care stakeholders perceived that independent prescribing was shaping the profession in the right direction (34) as well as increasing patients' convenience and benefiting healthcare delivery.(36,37) On the other hand, physicians expressed concerns about patient safety and delegation of authority.(36) Pharmacy owners and managers reported benefits to prescribing in addition to multiple workplace barriers.(35) Similarly, newspaper analysis revealed contradictory views, lack of clarity and a lack of consistency in pharmacists prescribing.(38) Pharmacists in BC were in favour of potentially prescribing oral contraceptive pills, but had concerns about liability.(45) On the other hand, pharmacists in Alberta with experience defined prescribing in one of three ways: the physical task of writing a prescription, integral part of patient care and legislated the definition of prescribing.(33) Results were not included in one paper on study design.(44) Nine of ten studies used qualitative methods: qualitative only (33-38) or in combination with quantitative surveys (44-46). Face-to-face, telephone, and interview surveys were used in these nine studies. A documented analysis was added to one group of interviews (37) and was the sole method in another (38).

We found 11 studies on "**practice change,**" that concentrate in three areas: the extent of pharmacist prescribing, factors that influence pharmacists uptake of prescribing, and impact of prescribing on workload and collaboration **(Table 2.3)**.(14-17, 19, 20, 39-43) Level and extent of prescribing adoption in different settings were analyzed in two studies. These studies found greater adoption of advanced prescribing activity in patient-focused pharmacists than product focused ones (40) and, practice of adjusting ongoing medications than initiating a new prescription by pharmacists with additional prescribing authority(19). Six studies summarized

factors influencing pharmacist prescribing. Three of these studies reported the value of additional prescribing authority and increased efficiency as motivating factors, increased risk, liabilities and lengthy application processing as draw backs. (14, 41, 42), Practice setting was found as impelling factor as there was more patient-focused prescribing in primary care network than in community setting(39). Again, two surveys pharmacists' showed personality traits as driving factor of adoption of prescribing and reported that pharmacists with more extroversion and openness made progress on their applications for additional prescribing authority.(15, 16) Pharmacist prescribing also affected their workload and collaboration.(17,20,43) Increased service time and labour cost were found in British Columbia due to adaptation service by pharmacists.(17) In Saskatchewan, researchers will be looking at pharmacist workload after the introduction of prescribing.(20) Pharmacist prescribing influenced collaboration and interprofessional communication.(43) In the community setting, collaboration is encouraged by the process of informing prescribing decision to another prescriber especially physicians. In collaborative teams, pharmacists are empowered with the ability of assessing patients and implementing care plan.(43) Mostly quantitative survey methods were used in this research area.(14-17, 19, 20) One abstract was on study design and did not report any result.(20) In qualitative studies, researchers analyzed semi-structured telephone interviews (39, 40) and written responses to open-ended questions on an e-mail survey(41).

"**Regulatory changes**" were the focus in two studies **(Table 2.4)**.(10, 47) In the first, researchers summarized prescribing rights across Canada and identified significant diversity among provincial regulations.(10) In the second, a policy analysis of legislation in Alberta found that pharmacist prescribing resulted from a legislative opportunity that was supported by strong

communication among stakeholders, research evidence, and early identification and resolution of stakeholder barriers (47).

Two studies concentrated on evaluating "**training**" programs to improve knowledge of prescribing pharmacists **(Table 2.5)**.(21, 49) One study found that training significantly increased pharmacists knowledge of prescribing the Emergency Contraceptive Pill (ECP).(21) A qualitative abstract described a collaborative project in which five pharmacists from Nova Scotia participated in a one-week training program on independent pharmacist prescribing in Scotland.(49)

2.6 Discussion

We addressed three objectives in this review of the pharmacy practice literature on pharmacist prescribing in Canada. First, by analyzing the design trend, we found research favoured quantitative methods; second, by examining the breadth of different research areas in this field, we observed similar prominence of research on outcome or impact and perception regarding pharmacist prescribing; and finally, the analysis of key findings provided us with information about positive healthcare outcomes of pharmacist prescribing, contradictory views of different stakeholders and different aspects of practice changes.

In terms of study design, we found predominately quantitative methods with surveys and trials and experimental designs and fewer qualitative or mixed methods studies. In contrast, researchers in the UK used mostly qualitative methods to understand the prescribing activity by pharmacists.(50) As prescribing by pharmacists is a new paradigm in Canada, the use of qualitative research methods may help us to acquire in-depth understanding of how and why pharmacists are behaving in a particular way.(51) We found three mixed method studies, which may generate in-depth and multifaceted information to understand pharmacist prescribing.

In the spectrum of research areas, a major emphasis on outcome and equivalent importance on perception and practice change were found in the literature; in contrast, most of the literature based on UK practice explored perceptions of different stakeholders with a limited focus on clinical and economical outcome and practice change.(52) A substantial application of quantitative research methodology was found in this area to understand outcome (17, 18, 22-32) and practice change (14- 16, 19, 20), whereas most of the qualitative and mixed method approaches were used to explore perceptions or insights about pharmacist prescribing (34-38, 44, 45) and practice change(39-43). The growing quantitative research may indicate a need for a meta-analysis addressing the impact of pharmacist prescribing on patient health.

Research on stakeholders perceptions on pharmacist prescribing in Canada suggests the coexistence of multiple and contradictory views.(38) On one hand, government and pharmacists exhibited immense support of prescribing to improve patients' access to medications(37); on the other hand, physician expressed concerns over patient safety and pharmacists' lack of diagnostic skill.(36) Physicians in the UK believe supplementary prescribing (i.e., physicians have direction oversight) by pharmacists improved overall patient care but concerns were expressed regarding independent prescribing and pharmacists' role in diagnosis.(36,53) Negative outcomes of pharmacist prescribing have not been documented in the literature. In contrast, Canadian research shows that pharmacist prescribing improved patient outcomes.(18, 22, 29, 48) In Canada, the general public tentatively supported an expanded role for pharmacists in tasks familiar to patients such as continuing ongoing medication therapy.(2) Conversely, patients in the UK perceived pharmacists as an alternative to doctor prescribing in primary care and there is general acceptance of pharmacists prescribing.(52,54) In Australia, patients supported pharmacists' prescribing roles; but preferred that physicians play the main role in diagnosis.(55)

Still, the literature suggests the general public and physicians have a low level of understanding and speculative beliefs about an expanded role of pharmacists and this may be due to a lack of clear communication.(2,36) Accordingly, there is further opportunity to evaluate the experience of other healthcare professionals and the public with different types of pharmacist prescribing as they can experience with pharmacists in these nascent roles. Pharmacist prescribing may have impacts on interdisciplinary collaboration especially with physicians and extent of collaboration may depend on the complexity of the situation. Physicians may warrant collaboration while the pharmacist is prescribing in the multifaceted situation on the other hand pharmacist can be confident enough to prescribe independently in the less complex situation. Future research is needed to explore the impact of pharmacist prescribing on interdisciplinary collaboration. With increased experience in prescribing, researchers may identify how pharmacist prescribing, especially by renewal or in an emergency, changes patients' behaviors around obtaining and taking medications as well as adherence to drug therapy.

We identified several additional gaps in the literature. Geographically, prescribing research has focused on individual provinces and not the country as a whole. Prescribing was implemented at different times and in different ways in Canada, making national projects challenging. However, comparisons between provinces may identify best practices for pharmacist prescribing. Researchers could identify the impact of differing prescribing models on health care costs, physician's services, and medication budgets. Empirical data could establish if pharmacist prescribing does indeed increase patient access to medications and reduce physician's workload as promised.

In Canada, pharmacists with a more patient centred practice were more likely to prescribe as they saw increased efficiency and value in practice. Overall, many pharmacists reported training

needs and physicians' response as barriers to their practice change.(14, 27, 41) This is similar to the findings of UK based research.(56,57) There is one study regarding the impact of training on knowledge to prescribe but it only concerns emergency contraceptive pill.(21) However, it is necessary to find ways of addressing training requirements and educating pharmacists as well as physicians and other healthcare professionals regarding the scope of pharmacy practice.

Our conclusions are limited in a few ways. We narrowed our search to research articles and did not include the grey literature, theses or dissertations. We did not assess the quality of the research as per scoping review methodology.

2.7 Knowledge into practice

We found a new body of research demonstrating the benefit of pharmacist prescribing on patient health such as better management of chronic diseases, increased use of emergency contraceptive pill etc. as well as the presence of contradictory view on pharmacist prescribing among stakeholders and patients. The pharmacy profession needs to effectively communicate the benefits of pharmacist prescribing in both individual interactions and promotional communication while remaining sensitive to the differing views of stakeholders. Researchers can focus on developing strategies to improve medication adherence, cost saving, and interprofessional collaboration through appropriate application pharmacist prescribing. Researchers and pharmacists could work together to evaluate prescribing models between provinces to allow for the identification of best policies and practices.

2.8 Conclusion

A developing body of research used mostly quantitative, qualitative and a few mixed methods to understand the effect and adoption of prescribing by pharmacists, related regulatory changes, and insights about this new paradigm of healthcare practice in Canada. Pharmacist prescribing

resulted in improvement in some chronic disease management (e.g. Diabetes mellitus type 2, hypertension), use of emergency contraceptive pills. Stakeholders had diverse and at times contradictory understanding of pharmacist prescribing. Gaps in the literature include the impact of pharmacist prescribing on patients' behaviours, medication adherence, cost saving, and the health systems. Future research directions may explore pharmacist prescribing in the context of an interprofessional health care system and identify strategies to improve the collaborative relationship of pharmacists with physicians and other healthcare professionals.

2.9 References

1. Tonna AP, Stewart D, McCaig D. An international overview of some pharmacist prescribing models. *J Malta College Pharm Pract.* 2008;(14):20-26.
2. Perepelkin J. Public opinion of pharmacists and pharmacist prescribing. *Can Pharm J.* 2011;144(2):86-93.
3. Sketris I. Extending prescribing privileges in Canada. *Can Pharm J.* 2009;142(1):17-19.
4. Yuksel N, Eberhart G, Bungard TJ. Prescribing by pharmacists in Alberta. *Am J Health Syst Pharm*. 2008;65(22):2126-32.
5. Emmerton L, Marriott J, Bessell T, Nissen L, Dean L. Pharmacists and prescribing rights: Review of international developments. *J Pharm Pharm Sci.* 2005;8(2):217-225.
6. Department of Health, the United Kingdom. Improving patients' access to Medicines: A guide to implementing Nurse and Pharmacists Independent Prescribing within the NHS in England. 2006 Apr; Gateway reference: 6429.
7. American Society of Health System Pharmacists. List of States by Statutory and Regulatory Authority. 2006.

8. Gebhart F. Drug Topics. California gives prescribing clout over controlled substances. 2004; [Updated 2004 Dec 13; cited 2017 May 20]. Available from: http://drugtopics.modernmedicine.com/drug-topics/news/california-gives-pharmacists-prescribing-clout-over-controlled-substances.
9. Ukens C. Florida VA pharmacists pioneer independent prescribing, *Hosp Pharm.* 1997; (11):33.
10. Law MR, Ma T, Fisher J, Sketris IS. Independent pharmacist prescribing in Canada. *Can Pharm J (Ott).* 2012;145(1):17-23.
11. Canadian Pharmacists Association. Environmental Scan: Pharmacy Practice Legislation and Policy Changes across Canada 2014; [Updated 2014; cited 2017 May 20]. Available from: http://blueprintforpharmacy.ca/docs/resource-items/scope-of-practice---september-2014.pdf.
12. Arksey H, O'Malley L. Scoping Studies: Towards a Methodological Framework. *Int J Social Research Methodology.* 2005;8(1):19-32.
13. Drysdale JS, Graham CR, Spring KJ, Halverson LR. An analysis of research trends in dissertations and theses studying blended learning. *Internet High Educ.* 2013;17(0):90-100.
14. Hutchison M, Lindblad A, Guirguis L, Cooney D, Rodway M. Survey of Alberta hospital pharmacists' perspectives on additional prescribing authorization. *Am J Health-Syst Pharm.* 2012;69(22):1983-1992.
15. Hall J, Rosenthal M, Family H, Sutton J, Hall K, Tsuyuki RT. Personality traits of hospital pharmacists: toward a better understanding of factors influencing pharmacy practice change. *Can J Hosp Pharm.* 2013;66(5):289-295.

16. Rosenthal M, Tsuyuki RT. Does personality explain research performance?. *Can Pharm J (Ott).* 2012;145(4):S24.

17. Marra CA, Lynd LD, Grindrod KA, Joshi P, Isakovic A. Evaluating the labour costs associated with pharmacy adaptation services in British Columbia. *Can Pharm J (Ott).* 2012;145(2):78-82.

18. Mansell K, Bootsman N, Kuntz A, Taylor J. Evaluating pharmacist prescribing for minor ailments. *Int J Pharm Pract*. 2015; 1;23(2):95-101.

19. Guirguis LM, Hughes CA, Makowsky M, Sadowski CA, Schindel TJ, Yuksel N. Pharmacists' prescribing practices in Alberta: Report of a provincial survey. *Can Pharm J (Ott).* 2014;147(4):S6

20. Jain R, Roy Dobson D. Preliminary findings of a study of experience with prescriptive authority (PA) services among Saskatchewan community pharmacists. *Can Pharm J (Ott).* 2014;147:S49.

21. Neubauer SL, Suveges LG, Phillips KA, Kolodziejak LR. Competency assessment of pharmacists providing emergency contraception. *Can Pharm J (Ott).* 2004;137(2):28-33.

22. Al Hamarneh YN, Charrois T, Lewanczuk R, . Pharmacist intervention for glycaemic control in the community (the RxING study). *BMJ Open* 2013;3:e003154

23. Law MR, Morgan SG, Majumdar SR, Lynd LD, Marra CA. Effects of prescription adaptation by pharmacists. *BMC Health Serv Res.* 2010;10(1):313.

24. Charrois TL, McAlister FA, Cooney D, Lewanczuk R, Kolber MR, Campbell NR, et al. Improving hypertension management through pharmacist prescribing; The rural Alberta clinical trial in optimizing hypertension (Rural RxACTION): Trial design and methods. *Implement Sci.* 2011;6(1):94.

25. McAlister FA, Majumdar SR, Padwal RS, Fradette M, Thompson A, Buck B, et al. Case management for blood pressure and lipid level control after minor stroke: PREVENTION randomized controlled trial. *CMAJ.* 2014; 186(8):577-84.
26. Tsuyuki RT, Houle SK, Charrois TL, Kolber MR, Rosenthal MM, Lewanczuk R, et al. A 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 Jun; 115
27. Rosenthal M, Ross Tsuyuki R, A community-based approach to dyslipidemia management: Pharmacist prescribing to achieve cholesterol targets (RxACT Study). *Can Pharm J (Ott)*. 2014;147(4):S20
28. Al Hamarneh Y, Tsuyuki R, Hemmelgarn B, Jones C, Oladele D. The design of the Alberta Vascular Risk Reduction Community Pharmacy Project: RxEACH. *Can Pharm J (Ott).* 2014;147(4):S46
29. McKinnon A, Jorgenson D. Pharmacist and physician collaborative prescribing: For medication renewals within a primary health centre. *Can Fam Phys.* 2009;55(12):e86-e91.
30. Soon J, Leung V, Smith A, Shoveller J. Temporal and regional differences in emergency contraception use: A population-based analysis. *Contraception.* 2011;84(3):327.
31. Houle SK, Charrois TL, McAlister FA, Kolber MR, Rosenthal MM, Lewanczuk R, et al. Pay-for-performance remuneration for pharmacist prescribers' management of hypertension: A pre-specified sub-study of the Alberta Clinical Trial in Optimizing Hypertension (RxACTION). *Can Pharm J (Ott).* 2014; 149(6):345-51.

32. Al HamarnehY, Sauriol L, Tsuyuki R. Economic analysis of the RxING study. *Can Pharm J (Ott).* 2014;147(4):S47

33. Hughes CA, Makowsky M, Sadowski CA, Schindel TJ, Yuksel N, Guirguis LM. What prescribing means to pharmacists: a qualitative exploration of practising pharmacists in Alberta. *Int J Pharm Pract.* 2014; 22(4):283-291.

34. Charrois TL, Rosenthal M, Hoti K, Hughes C. Pharmacy Student Perceptions of Pharmacist Prescribing: A Comparison Study. *Pharmacy* .2013;1(2):237-247.

35. Grindrod KA, Lynd LD, Joshi P, Rosenthal M, Isakovic A, Marra CA. Pharmacy Owner and Manager Perceptions of Pharmacy Adaptation Services in British Columbia. *Can Pharm J (Ott).* 2011;144(5):231-235.

36. Henrich N, Joshi P, Grindrod K, Lynd L, Marra C. Family Physicians' Perceptions of Pharmacy Adaptation Services in British Columbia*. Can Pharm J (Ott).* 2011;144(4):172-178.

37. Pojskic N, MacKeigan L, Boon H, Austin Z. Initial perceptions of key stakeholders in Ontario regarding independent prescriptive authority for pharmacists. *Res Social Adm Pharm* 2014;10(2):341-354.

38. Schindel TJ, Given LM. The pharmacist as prescriber: A discourse analysis of newspaper media in Canada. *Res Social Adm Pharm* 2013;9(4):384-395.

39. Guirguis LM, Makowsky MJ, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N. How have pharmacists in different practice settings integrated prescribing privileges into practice in Alberta? A qualitative exploration. *J Clin Pharm Ther.* 2014; 39(4): 390-98.

40. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Yuksel N. Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. *Implement Sci.* 2013; 14;8:109-5908-8-109.
41. Charrois T, Rosenthal M, Tsuyuki RT. Stories from the trenches: Experiences of Alberta pharmacists in obtaining additional prescribing authority. *Can Pharm J (Ott).* 2012;145(1):30-34.
42. Guirguis L, Dolovich L, Hughes C, Makowsky MJ, Sadowski CA, Schindel TJ, et al. Pharmacists' perceptions of prescribing in two Canadian jurisdictions. *Can Pharm J (Ott)*. 2014;147(4):S21
43. Schindel TJ, Given L. CAIS Paper: 'Collaboration' is the New Black: Independent Pharmacist Prescribing in a Collaborative Environment. In Proceedings of the Annual Conference of CAIS/Actes du congrès annuel de l'ACSI 2016 Jun 21.
44. Guirguis L, Cooney D, Dolovich L, Eberhart G, Hughes C, Makowsky M. Exploring pharmacists' understanding and adoption of prescribing in 2 Canadian jurisdictions: Design and rationale for a mixed-methods approach. *Can Pharm J (Ott).* 2011;144(5):240-244.
45. Norman WV, Wong M, Soon J, Zed P. DO rural pharmacists in British Columbia find independent prescribing of hormonal contraceptives feasible and acceptable? The "act-pharm" study. Contraception. 2013;88(3):451-452.
46. Bishop AC, Boyle TA, Morrison B, Barker JR, Zwicker B, Mahaffey T, et al. Public perceptions of pharmacist expanded scope of practice services in Nova Scotia. *Can Pharm J (Ott).* 2015; 148(5):274-83

47. 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.

48. Lyster RL, Houle SK. Abnormal vaginal bleeding following pharmacist prescribing of metformin leads to the detection of complex endometrial hyperplasia. *Ann Pharmacother*. 2013; 47(11):1581-1583.

49. Addison B, Weidmann A, Diane Harpell D, et al. Pharmacist prescribing education: An international knowledge exchange study. *Can Pharm J (Ott).* 2014;147(4):S42

50. Cooper RJ, Anderson C, Avery T, Bissell P, Guillaume L, Hutchinson A, et al. Nurse and pharmacist supplementary prescribing in the UK--a thematic review of the literature. *Health Policy.* 2008;85(3):277-292.

51. Tonna AP, Edwards RM. Is there a place for qualitative research methods in pharmacy practice? *Eur J Hosp Pharm Sci Pract.* 2012;20(2):97-99.

52. Tonna AP, Stewart D, West B, McCaig D. Pharmacist prescribing in the UK - a literature review of current practice and research. *J Clin Pharm Ther.* 2007;32(6):545-556.

53. Lloyd F, Hughes CM. Pharmacists' and mentors' views on the introduction of pharmacist supplementary prescribing: a qualitative evaluation of views and context. *Int J Pharm Pract.* 2007;15(1):31-37.

54. Gerard K, Tinelli M, Latter S, Blenkinsopp A, Smith A. Valuing the extended role of prescribing pharmacist in general practice: results from a discrete choice experiment. *Value Health.* 2012;15(5):699-707.

55. Hoti K, Hughes J, Sunderland B. An expanded prescribing role for pharmacists - an Australian perspective. *Australas Med J.* 2011;4(4):236-242.

56. Hughes CM, McCann S. Perceived interprofessional barriers between community pharmacists and general practitioners: a qualitative assessment. *Br J Gen Pract.* 2003;53(493):600-606.

57. George J, Pfleger D, McCaig D, Bond C, Stewart D. Independent prescribing by pharmacists: a study of the awareness, views and attitudes of Scottish community pharmacists. *Pharm World Sci.* 2006;28(2):45-53.

Table 2.1 Research on Outcomes of Pharmacist Prescribing

Author & year	Research Objective	Subject and Location	Method	Analysis	Results/Key Findings	Research design
Mansell K et al., 2014 (18)	To evaluate self-reported symptomatic improvement after minor ailment prescribing by pharmacist.	Saskatchewan: Patients who were prescribed by pharmacists for minor ailment	After pharmacist prescribing for minor ailment, patients were asked to complete an online survey to report symptomatic improvement	Mean of the feedback was measured based on the score of 1 (strongly disagree), 2 (disagree), 3 (agree) and 4 (strongly agree)	80.8%participants reported that symptoms improved significantly.	Quantitative
Al Hamarneh YN et al. 2012 (22)	To determine the effect of community pharmacist prescribing on glycaemic control in patients with poorly controlled type 2 diabetes.	Alberta: Type 2 diabetes receiving oral hypoglycaemic medications and with glycated haemoglobin (HbA1c) of 7.5–11%.	An experimental study where pharmacist prescribed glargine insulin as per protocol	Paired T-test: to compare HbA1c between baseline and 26 weeks & T-test and basic frequencies: Proportion of patients achieving target HbA1c, changes in oral hypoglycaemic agents, quality of life and patient satisfaction, persistence on insulin glargine, number of insulin dosage	HbA1c was reduced from 9.1% at baseline to 7.3% and fasting plasma glucose was reduced from 11 to 6.9mmol/L. 51% of the patients achieved the target HbA1c of ≤7%.	Quantitative

				adjustments per patient and number of hypoglycaemic episodes		
Law MR et al., 2010 (23)	To evaluate how pharmacist adaption and renewal of prescriptions impacted medication and health care use	British Columbia: General patients	Three population-based, administrative data sources: BC PharmaNet, Health Services Data from Population Data BC, Income Data and administrative billings from physicians and hospital discharges	Characterize the adaptations. Interrupted Time Series Analysis on changes in drug utilization and costs, medication adherence, and ambulatory care visits and hospitalizations.	n/a	Quantitative
Charrois T et al., 2011 (24)	To evaluate outcomes in patients who are prescribed antihypertensive therapy by pharmacists.	Alberta: Patients in rural areas with undiagnosed or uncontrolled BP	Randomized controlled trial of enhanced pharmacists care. Patients are randomized to either enhanced pharmacist care or usual care.	Comparison of baseline characteristics using two samples, two sided t-tests or nonparametric Wilcoxon for continuous variables and chi-squared test for categorical variables	n/a	Quantitative

McAlister et al. 2014 (25)	To compare 2 modes of hypertension management: pharmacist led management by active prescribing versus nurse led management by screening and delegating to primary care physician.	Alberta: Patient with history of prior stroke and high systolic BP and high cholesterol (LDL) levels	A 6 months prospective, randomized controlled open-label trial with blinded ascertainment of outcomes. Patients were screened and allocated 1:1 to intervention group (pharmacists led management) and to active control group (nurse led management)	Pre-specified BP and LDL and HDL cholesterol levels were the primary outcome after six months. 2 sample independent T test was used to compare changes in outcomes. Multiple logistic regressions were used to adjust study site and clinically important or statistically significant baseline differences.	A substantially improved risk factor control was found in pharmacist led management group at 6 months compared to nurse led management group.	Quantitative
Tsuyuki R et al. 2014 (Abstract) (26)	To evaluate the effect of pharmacist care (including prescribing) on systolic blood pressure (SBP) in patients with uncontrolled hypertension	Alberta: Adult patients with BP above recommended targets	Randomized controlled trial Intervention group: Pharmacist assessment, education, pharmacist prescribing of antihypertensive drugs and laboratory monitoring plus	Differences in reduction of systolic blood pressure between the intervention and control groups were observed at six months.	Pharmacist prescribing resulted in significant reduction in SBP of 18.0 mmHg compared with 11.0mm Hg in the control group	Quantitative

			monthly follow-up visits. Control group: patient education and no specific follow-up			
Rosenthal M et al. 2014 (Abstract) (27)	To determine the impact of pharmacist prescribing and follow-up in patients with dyslipidemia not at recommended treatment targets	Alberta: Adult patients with uncontrolled dyslipidemia (treated or untreated)	Randomized trial of pharmacist prescribing vs. usual care. Intervention: Pharmacists reviewed cardiovascular risk, LDL-C levels, and prescribed lipid-lowering medications. Control group: Patients received usual pharmacist and physician care, LDL-C levels and educational materials	Independent t-test was used to compare the change in LDL level between groups	Pharmacist prescribing and follow-up resulted in more than a 2 fold reduction in LDL	Quantitative

Al HamarnehY et al. 2014 (Study Protocol)(Abstract) (28)	To determine the impact of a community pharmacy-based case finding and intervention program on reduction in cardiovascular risk	Alberta: adults at high risk for cardiovascular events identified by the pharmacist	Randomized controlled trial. Intervention: Pharmacist will conduct a structured medication review, prescribe, adapt, or recommend medications as necessary. Follow up for 3 months. Control group: Usual care by the pharmacist and physician. Patients are crossed over to receive intervention for the next 3 months.	Independent t-test will be used to determine the difference in change in cardiovascular risk between groups	n/a	Quantitative
McKinnon A, 2009 (29)	To determine if there is improvement in medication management when pharmacists and family physicians collaborate to prescribe medication	Saskatchewan: Patients whose pharmacies faxed the health centre requesting prescription renewals	Prospective, non-randomized controlled trial. Intervention group: pharmacists assessed drug-therapy issues and made a collaborative	Chi-squared and independent t-test to compare outcomes between control and intervention groups. Outcomes: renewals, recommendations, new test and	Control group: Had significantly more requests authorized with no recommendations. Intervention group: significantly more medication-	Quantitative

	renewals requested by fax		prescribing decision with physicians. Control group: physicians managed the renewal requests independently	appointments	related problems identified; medication changes made and appointments scheduled with their family physicians	
Soon J et al., 2011(Abstract) (30)	To evaluate how pharmacist prescribing impacted Emergency Contraceptive (EC) use.	British Columbia: Women aged 15-24 years	Quantitative analysis of provincial drug claims database	Correlation analysis: association between the rate of EC prescriptions and sociodemographic variables over time	EC use doubled across all geographic regions after pharmacist prescribing	Quantitative
Houle S et al. 2014(Abstract) (31)	To determine the impact of paying prescribing pharmacist by fee-for-service (FFS) or pay-for-performance (P4P) on patient blood pressure (BP)	Alberta: Patients with elevated BP	Observational study. The effects of paying pharmacists by FFS and P4P for providing enhanced care to patients with elevated BP were examined	Independent t-test was used to compare the difference in change in systolic BP between groups	Both group showed substantial reductions in SBP but no appreciable difference in the magnitude of BP reduction was achieved	Quantitative
Al HamarnehY et al. 2014 (Abstract) (32)	To evaluate pharmacists' early intervention in prescribing insulin to people with type 2 diabetes (T2DM) in terms of the cost-	Alberta: Documents and data from RxING study (20)	Assessed complications and disutilities using IMS CORE Diabetes Model, a Markov structure and	Quality adjusted life year (QALY) and economic analysis were conducted	Pharmacists' initiating insulin sooner in uncontrolled T2DM resulted in improved quality of life and	Quantitative

	effectiveness and patients' quality of life		Monte Carlo simulation Model. Efficacy of insulin obtained from RxING study.		survival rates with an increment in cost-savings	
Lyster RL, 2013 (48)	To describe a case where a patient experienced unexplained vaginal bleeding with complex endometrial hyperplasia due to metformin prescribed by a pharmacist	Alberta: A woman with metabolic disorder detected by pharmacist and confirmed by physician	Case study: Pharmacist prescribed 500 mg of metformin twice a day to treat metabolic disorder. Patient had vaginal bleeding (dose dependent). Patient diagnoses with hyperplasia.	Used Naranjo probability scale to understand the probable association of drug therapy with the symptoms observed	In collaboration with other health care professionals, pharmacist prescribing detected endometrial hyperplasia.	Case study

Table 2.2 Research on Perception of Pharmacist Prescribing

Author & year	Research Objective	Subject and Location	Method	Analysis	Results/Key Findings	Research design
Perepelkin J. 2011 (2)	To understand public perceptions of pharmacists, and the acceptance of possible expanded roles for pharmacists, including prescribing.	Saskatchewan: General people	A telephone survey of 43 items was conducted in February and March of 2010 to assess public perceptions of pharmacists and their scope of practice.	Basic descriptive statistics, one-way ANOVA, statistical analysis (Scheffe) when statistically significant differences were ($\alpha<0.05$).	Limited support for an expanded role for pharmacists. Public perceived that pharmacists provide knowledge about medications to patients. Public supported pharmacists prescribing in emergency situations but not altering prescriptions, diagnosis or new prescriptions	Quantitative
Hughes C et al. 2014 (33)	To understand how pharmacists describe prescribing and its application in pharmacy practice	Alberta: Pharmacists working in community, hospital, primary care networks or other settings	Semi-structured telephone interviews	Interpretive Description approach to identify themes; grounded in Diffusion of Innovation theory	Three themes: physical task of writing a prescription, integral part of patient care and legislated definition of prescribing.	Qualitative

Charrois T et al. 2013 (34)	To understand the pharmacy students' perceptions or view on pharmacist prescribing in two different countries (Canada and Australia)	Alberta and Australia: Fourth year pharmacy students of University of Alberta and Curtin University	Focused group interview	Qualitative approach using content analysis	4 main themes were revealed: benefits, fears, needs and pharmacist roles. Canadian students supported independent prescribing whereas Australian students were accepting of supplementary prescribing	Qualitative
Grindrod KA et al., 2011 (35)	To illustrate the pharmacy manager's and owners' perception about pharmacist adaption services in BC	British Columbia: Pharmacy owners, managers from "high-adapter" pharmacies and "low-adapter" pharmacies	Semi structured interview on 4 main subject areas: pharmacist uptake, capital costs, revenue, perceptions	Content analysis by 2 researchers	Perceived motivating factors: perceived benefit of stakeholders. Perceived barriers: additional time, additional human resources, training time, lack of collaboration with physicians, insufficient remuneration	Qualitative

Henrich N et al., 2011 (36)	To reveal the perceptions and attitudes of family physicians about the pharmacy adaptation services	British Columbia: Physicians of 5 regional health authorities of BC	Focus group and individual interviews	Descriptive approach was used for thematic coding and analysis	Physicians had limited experience, but a negative outlook specially regarding the consequences to their patients' health, acknowledged patient conveniences when access to physicians is difficult	Qualitative
Pojskic N et al, 2014 (37)	To report initial perception of Ontario government, pharmacy and medical professional group about pharmacists' expanded role as prescribers	Ontario: Policy documents and key informants of Ontario Government and Health professional stakeholder groups	Obtained policy document related to Ontario pharmacists' expanded scope of practice and semi-structured interviews	Content analysis of both document and interview transcripts by investigator and 2 co-investigators until the data saturation was reached.	Government and pharmacy professional group agreed with increased patient convenience and benefit to health care system as a result of pharmacist prescribing. On the other hand, physicians showed concern about patient safety and delegation of	Qualitative

					authority	
Schindel TJ, 2013 (38)	To analyze newspaper media coverage of pharmacist prescribing 1 year before and 2 years after prescribing was implemented in Alberta	Alberta: Pharmacist prescribing related news	Qualitative analysis of pharmacist prescribing related news published in national and local newspapers over a 3 years period after the pharmacist prescribing declaration	Discourse analysis of news, editorials, and letters by using lens of social positioning theory	Five themes were elicited: qualifications, diagnosis, patient safety, physician support, and conflict of interest. Binary positioning was found in discussion about pharmacist prescribing rights	Qualitative

Guirguis LM et al. 2011 (44)	To investigate pharmacists' perceptions of prescribing, the extent to which prescribing has been incorporated into pharmacists' practices and the factors that have influenced its uptake	Alberta & Ontario: Currently practicing pharmacists	Mixed Method: In stage 1, semi structured interviews of Pharmacists in Alberta and Ontario, In stage 2, survey development guided by the responses from stage 1. Stage 3,a mixed method survey of a large sample	Stage 1: Interpretive description for qualitative method. Stage 2: Descriptive statistics. Exploratory factor analysis for validity and Cronbach's alpha for reliability. Stage 3: Descriptive statistics. Statistical comparison using chi-square, t-test, ANOVA and multiple regressions to identify predictors of pharmacist prescribing such as motivating factors and barriers.	n/a	Mixed Methods
Norman WV et al., 2013 (Abstract) (45)	To explore the acceptability and feasibility for independent provision of contraception by pharmacists in rural British Columbia (BC)	British Columbia: Rural pharmacists	Mixed method: Mailed survey to rural pharmacies in BC and participants were invited to have a structured telephone interview where the questions followed Rogers' diffusion of innovation theory.	n/a	85% of the participants showed interest in prescribing hormonal contraceptives. Pharmacists required clarification about related assessment protocol and liability issues.	Mixed Methods

Boyle T et al., 2014 (Abstract) (46)	To understand the public attitude towards pharmacists expanded scope of practice (ESOP)	Nova Scotia: General people	Mixed method: In-pharmacy intercept survey and an online survey consisting of open ended and 5 point scale. ESOP included: prescribing for minor ailments; medication reviews; injections and vaccinations; and prescription renewals	Thematic analyses, descriptive statistics and comparisons based on practice awareness using MANOVA	Pharmacist knowledge and medication history on file influenced the public's decision to use ESOP. The public were comfortable with prescription renewals, but had varying level of awareness.	Mixed Methods

Table 2.3 Research on Practice Change with Pharmacy Prescribing

Author & year	Research Objective	Subject and Location	Method	Analysis	Results/Key Findings	Research design
Hutchison M et al., 2012 (14)	To determine reasons for the slow adoption of prescribing authority by hospital pharmacists	Alberta: Hospital and institutional pharmacists	A cross sectional survey on factors influencing the adoption of APA	Descriptive statistics. Responses were compared between pharmacists who had and those who had not applied for APA.	Factors motivating pharmacists to apply for APA: perceived relevancy and value, increased efficiency. Factors preventing APA application: lengthy application process, increased liability risk, challenges with patient follow up and documentation	Quantitative
Hall J et al., 2013 (15)	To characterize the personality traits of hospital pharmacists for understanding the potential obstacles to practice change.	Alberta: Hospital Pharmacists	A cross-sectional survey based on the Big Five Inventory that uses a 5-point Likert scale to measure the traits of extroversion, agreeableness, conscientiousness,	Univariate analysis of variance to assess any differences in responses related to age, duration of practice, role, full-time equivalence, location of hospital and whether or not	Pharmacists showed stronger expression of extraversion, agreeableness, conscientiousness, and openness and low levels of neuroticism. This	Quantitative

			neuroticism, and openness.	pharmacists had APA.	characterization explained their regular practice of seeking consent from other healthcare professionals and anxiety regarding adoption of prescribing.	
Rosenthal M, 2012 (16)	To determine the relationship between pharmacists' personality traits and performance in a research study on pharmacist prescribing	Alberta: 24 pharmacists from a large chain pharmacy who agreed to obtain additional prescribing authorization (APA)	Baseline pharmacists completed the validated Big Five Inventory and researchers tracked dropouts and APA status	n/a	Pharmacists who dropped out had lower levels of extroversion, agreeableness, conscientiousness and openness compared to those who made progress on their applications or submitted them	Quantitative
Marra CA et al., 2012 (17)	To evaluate the labor cost related topharmacy adaptation service	British Columbia: High adapting pharmacies	Cross sectional study by observing both non-adapted and adapted prescriptions from the workflow of purposefully selected pharmacies	Average total time to complete 10 stages of adaptation service was calculated and incremental labour cost was assessed from the difference of average cost of adapted and non-adapted prescription	Average time for adaptation service was 6:43 minutes longer than non-adaptation service. Increased labour cost for adapting a prescription was $6.10	Quantitative

Guirguis L et al. 2014 (Abstract) (19)	To characterize Pharmacists' prescribing practices in Alberta.	Alberta: Pharmacists	A cross-sectional web-based survey was conducted in a random sample	Analysis was descriptive. Prescribing behaviour and beliefs were compared between practices using ANOVA and chi-square.	93.4% of pharmacist prescribing. Most frequent: continuity of therapy (92.3%), adapting (73.4%) and medication substitution (80.5%). Pharmacists with APA mostly prescribe to adjust ongoing medications than initiating a new prescription.	Quantitative
Jain R 2014 (Study Protocol) (Abstract) (20)	To determine the impact of prescriptive authority (PA) services on the traditional professional practices and workload of community pharmacists	Saskatchewan: registered community pharmacists	Cross-sectional study using a mail-in questionnaire with an online option was used	n/a	n/a	Quantitative
Guirguis LM et al., 2014 (39)	To characterize pharmacists prescribing in different practice settings in	Same as Makowsky M et al. 2013 (25)	Same as Makowsky M et al. 2013 (25)	Same as Makowsky M et al. 2013 (25)	Prescribing practice was characterized as Product-focused, disease-focused	Qualitative

	Alberta since the legislation was approved and implemented				and patient-focused. Many community pharmacists adopted product focused prescribing. Hospital and primary care pharmacists focused on disease and patient focused prescribing.	
Makowsky M et al. 2013 (40)	To explore how pharmacists have adopted prescribing in practice 3 years after this legislation was implemented	Same as Hughes C et al. 2014 (33)	Same as Hughes C et al. 2014 (33)	Same as Hughes C et al. 2014 (33)	Prescribing behaviours: non-adoption, product, disease, and patient focused. Adoption depends on innovation itself, adopter, system readiness, communication and influence. Patient focused pharmacists were more likely to adopt advanced prescribing than product focused ones.	Qualitative

Charrois T et al., 2012 (41)	To examine the experiences of pharmacists regarding the decision to apply for APA and the application itself	Alberta: Pharmacists who had received their additional prescribing authorization (APA)	E-mail response to written responses to open ended questions regarding their experiences re: application for APA.	Content analysis by 2 independent reviewers.	3 main themes were revealed: motivation, hurdles and outcomes.	Qualitative
Guirguis LM et al., 2014 (Abstract) (42)	To understand pharmacists' perceptions about prescribing between those who were currently prescribing (in Alberta) and those preparing to prescribe (in Ontario).	Alberta and Ontario: Pharmacists working in community, hospital, primary care networks or other settings	Semi-structured, qualitative interviews (individual and group)	Thematic analyses were done for similarity and differences in two jurisdictions	Similar views were found in both groups regarding liability and importance of physician relationship, continuing education and environmental support. Pharmacists of Ontario were more concern about the liabilities whereas pharmacists of Alberta stated importance of physician relationships.	Qualitative
Schindel TJ, 2014 (43)	To explore collaboration associated with research on	Alberta: Documents 2001 to 2014 from Alberta	Qualitative analysis of documents representative of pharmacist	Discourse analytic approach was used to construct pharmacists' identity	Collaboration differs by location of pharmacist and physician and	Qualitative

	pharmacist prescribing.	and Canadian Pharmacists Associations.	prescribing and communications from pharmacy organizations in Canada	as prescribers. Analysis focused specifically on the theme of collaboration	influence by tension between independent and collaborative prescribing	

Table 2.4 Research on Regulatory Changes accompanying Practice Change

Author & year	Research Objective	Subject and Location	Method	Analysis	Results/Key Findings	Research design
Law MR et al., 2012 (10)	To summarize independent prescribing rights across Canada	Canada: Legislation or regulations regarding expanded pharmacists' scope of practice	Qualitative: Identified documents, regulations and interviewed officials from the relevant government and professional bodies	Province wise analysis of pharmacist requirements, continuing education requirements, rules, and reimbursement.	Pharmacists independently prescribe in 7 of 10 provinces: continuing existing prescriptions (7), adapting existing prescriptions (4) and initiating new prescriptions (3). Significant heterogeneity exists between provincial regulations.	Document Analysis
MacLeod-Glover N. 2011 (47)	To analyze the policy and legislative changes permitting pharmacists prescribing in Alberta	Alberta: Government and regulatory body documents related to healthcare systems and pharmacist prescribing	Qualitative: Systematic search of documents plus correspondence with authors and regulators to clarify or obtain current data	Explanatory analysis of problem definition, policy development process and consequences of implementation	Requirements: Legislative opportunity supported by communication between stakeholders, research evidence, and early identification of stakeholder barriers	Policy Analysis

Table 2.5 Research Evaluating Education on Pharmacist Prescribing

Author & year	Research Objective	Subject and Location	Method	Analysis	Results/Key Findings	Research design
Neubauer SL et al., 2004 (21)	To determine the impact of the training program on pharmacists knowledge about Emergency Contraceptive Pill (ECP)	Saskatchewan: Pharmacists who intended to participate in the ECP training program	Pre and post test scores were compared to determine whether the training addressed the pharmacist's knowledge gaps	Single group paired T-test to compare the pre and post training knowledge score	Pre-training score=14.4 (57.6%) Post-training = 22.1 (85%). There was a significant increase in knowledge of pharmacists on ECP after the training program ($p<0.05$)	Quantitative
Addison B et al. 2014 (Abstract) (49)	To carry out a pilot study allowing a group of Canadian pharmacists to participate in higher education training of independent pharmacist prescribing in Scotland	Scotland: Five pharmacists from Nova Scotia	Description of a collaborative project between the Robert Gordon University, Aberdeen, and Dalhousie University, College of Pharmacy, Halifax, NS.	n/a	One week program with an established independent pharmacist prescriber and online materials	Training program analysis

Chapter Three

Development and validation of a survey instrument to measure factors that influence Pharmacist Prescribing

Lisa M Guirguis, Christine A Hughes, Mark J Makowsky, Cheryl A Sadowski, Theresa J Schindel, Nese Yuksel, Chowdhury F Faruquee

3.1 Abstract

Objective: To develop a questionnaire to assess factors influencing pharmacists' uptake of prescribing in practice.

Methods: Survey questions were developed based on prior qualitative research. To establish face validity, content experts reviewed the questionnaire for accuracy and completeness. Pharmacists from diverse practice settings were purposefully recruited for a cognitive interview to verify the understanding and readability of the questionnaire. A pre-survey introduction letter was mailed via post with an incentive followed by an e-mail with a personalized link to the online survey, e-mail reminders, and a telephone reminder if required. The psychometric properties of five scales were evaluated with an exploratory factor analysis and Cronbach's alpha. Scale responses were described.

Results: Engagement of stakeholders, experts, and pharmacists in development of a robust survey regarding a new practice activity (i.e., prescribing) clarified definitions, terminology, recall periods, and response options for the 35 item response scale. Three hundred and seventy-eight pharmacists completed the online survey for a response rate of 54.6%. The factors analysis resulted in 27 questions in five scales: (1) self-efficacy, (2) support from practice (i.e., practice environment and interprofessional relationship), (3) impact on practice (i.e., professionalism and patient care),(4) prescribing beliefs, and (5) use of the electronic health record (i.e., technical and patient care). Prescribing beliefs and use of the electronic health record had moderate reliability while the remaining scales had strong evidence for reliability and validity.

Conclusion: Through the use of qualitative research and engagement of stakeholders a survey was developed to capture pharmacists' perceptions on prescribing influences. This survey tool

may help policy-makers and educators understand what influences the uptake of prescribing and allow for the development of sound, evidence-based method interventions to enhance adoption of appropriate prescribing and improve patients' access to care.

3.2 Introduction

The scope of pharmacist practice is expanding across the world. Pharmacist prescribing has taken root in the United States,(1) United Kingdom (UK),(2) and Canada.(3) Each jurisdiction has a unique model and pharmacists may not have a shared understanding of what constitutes prescribing as many standard practices such as recommending non-prescription medications, continuing existing medications, and dose adjustments may be considered prescribing in some contexts and not others.(4) Pharmacy practice researchers are striving to understand the uptake and application of prescribing privileges in the real world of practicing pharmacists.

In Alberta, Canada, three types of prescribing agreement were defined 1) adapting a prescription (i.e., adapting an existing prescription or extending a prescription for continuity of care), 2) prescribing in an emergency, and 3) additional prescribing authority (APA) (i.e., prescribing at initial access or to manage ongoing therapy). To obtain APA, pharmacists must complete a detailed application of sample patient cases which are assessed by peers. Alberta is an ideal province to study the extent of prescribing in pharmacy practice. No other jurisdiction in Canada has the range of prescribing privileges currently available to Alberta pharmacists.(3)

Our research group used qualitative methods to describe pharmacists' adoption of prescribing in Alberta and characterized their prescribing practices as focused on product, diseases, and patients.(5) Qualitative methods alongside the diffusion of innovations theory(6) were used to study pharmacists' adoption of prescribing. Pharmacists were influenced by physician

relationships, practice setting, how prescribing fit with previous practice behaviors as well as pharmacists' own self-efficacy toward prescribing, beliefs about patients' responsibility for prescribing and focus on patient care.

Survey research methods are suitable to gather large-scale descriptions of pharmacists' prescribing behaviors and build on the prior qualitative research. While surveys have been used in the UK to evaluate training programs around prescribing, these surveys were not applicable to Alberta as both the prescribing and practice models differ. No survey instrument exists that captures pharmacist prescribing in Alberta, so we aimed to develop a survey instrument.

3.3 Objectives

Our research objectives were to:

1) Develop a survey instrument to measure factors that influence pharmacists' adoption of prescribing

2) Describe use of pre-incentive and mixed mode survey

2) Establish the initial psychometric properties of the survey instrument

3.4 Methods

The survey was developed and then refined in three stages. Based on the conceptual model, prior literature, and data gathered from prior qualitative work, a survey instrument was developed to assess pharmacists' adoption of prescribing. Diffusion of innovation theory was used to shape and guide the question development. The survey questions were refined through 1) expert review for face-validity, 2) cognitive interviews, and 3) small-scale survey distribution. Evidence for validity was established with expert review and cognitive interview. Exploratory factor analysis and evidence for reliability were established by examining internal consistency

reliabilities with small and large-scale samples. This study was approved by the Health Ethics Research Board Panel B, University of Alberta.

3.4.1 Data Collection

3.4.1.1 Expert Review

To establish content validity, six expert pharmacists were identified by researchers via known contacts and asked to review the questions for accuracy and completeness. An information letter and the draft survey instrument were emailed to expert pharmacists. Written feedback informed a revised draft of the instrument.

3.4.1.2 Cognitive Interview

Ten pharmacists from a variety of settings were purposefully recruited to participate in a face-to-face cognitive interview. Researchers used structured probes to uncover how respondents interpreted questions to verify the understanding and readability. Individuals who participated in the expert review or cognitive interviews received a $50 gift card for their time.

3.4.1.3 Pilot Survey

The survey was pilot tested in a random sample of 100 practicing pharmacists who were registered with the Alberta College of Pharmacists (i.e., the provincial regulatory authority) and who provided contact information for research purposes including mailing, telephone, and e-mail. Prior survey work in North America has found low response rates, so a novel mixed-mode (post, email, and telephone) strategy with a pre-incentive was used to increase response rates.

Pharmacists were mailed a pre-survey notification letter and incentive of a $5 CAD coffee card for a national coffee and donut chain to enhance response. Survey links were e-mailed three weeks later with three reminders in two weeks. Population Research Laboratory (PRL)

interviewers telephoned pharmacists who did not respond after two reminders to encourage participation in the online survey and asked 10 questions to those who indicated they were not going to participate in the online survey. The methodology provided an opportunity to hear from the non-responder sub-group.

3.4.1.4 Main Survey

The main survey was conducted in a sample of 700 practicing pharmacists who were registered with the Alberta College of Pharmacists. As before, the PRL mailed pharmacists a pre-survey notification letter and incentive of a $5 CAD coffee gift card. Survey links were e-mailed two weeks later with five reminders over seven weeks. PRL interviewers telephoned pharmacists who did not respond after three reminders in a four-day period which was the same as the small-scale survey.

3.4.2 Data Analysis

The main learnings from expert review and cognitive interview data were summarized. Response rates were calculated by dividing the number of people who participated by the number selected in the eligible sample. Descriptive analyses were used to characterize results. Variables were plotted and examined for normal distributions. In order to test the convergent validity of the hypothesized scales, an exploratory factor analysis was conducted. Factor analysis reduced the number of items by grouping the related items and identifying the unrelated items for removal. Principal axis factoring was used, and factors with Eigenvalue's greater than one were chosen. To facilitate the interpretation, oblimin rotation was applied when the correlation between factors was >0.32.(7) A Kaiser-Meyer Olkin greater than five was used to measure data adequacy for dimension reduction. Before running factor analysis, a correlations matrix of survey items was used to identify and remove highly correlated (>0.90) or weakly correlated (<0.30) items from

the analysis. Items loaded on a factor if their loading was greater than 0.40 and no greater than 0.40 on another factor. Internal consistency of the scales was calculated using Cronbach's alpha statistics.(8)

3.5 Results

3.5.1 Survey Development

A comprehensive survey was designed to assess pharmacist prescribing behaviours and factors which influenced adoption of prescribing. Details of pharmacist prescribing behaviors have been published.(9) This paper focuses on survey items that affect pharmacists' adoption of prescribing specifically use of electronic health records, self-efficacy toward prescribing, supporting factors, impact on practice and prescribing beliefs (Table 3.1, 3.2, and 3.3) which are grounded in the Diffusion of Innovation Theory for Healthcare.(6)

The survey questions were drawn from findings in our prior qualitative work(5,10) and published surveys. The survey developed by Latter et al. provided insight on how to measure benefits of prescribing.(11) Questions on the technical and social benefits as well as perceived compatibility of prescribing were adapted from Westrick's survey on pharmacists' adoption of immunization services.(12) Pronk used Roger's Diffusion of Innovation Theory to look at specific attributes of a pharmacy service innovation and six questions scale on observability, compatibility, trialability, relative advantage and complexity were added.(13) New questions were developed around self-efficacy, physician relationships, electronic health record use, patients' responsibility for ensuring continuity of care and legitimizing prior practices.(10)

The survey instrument started with practice descriptors then pharmacists were routed to site-specific questions for community, hospital, primary care network, and continuing care which

were designed to characterize the level of care provided at the practice sites. The second section captured pharmacists prescribing behaviors which have been described in the literature. These results have been reported.(14) All pharmacists who had prescribed in the last month were asked about the barriers and supports for prescribing, the impact of prescribing on professional activities, and self-efficacy toward prescribing. The third section addressed pharmacists' beliefs about prescribing. The fourth and last part captured pharmacists' demographics, training, and the presence of other prescribers, as well as time spent with patients versus technical duties. Pharmacists who did not provide patient care did not complete the second section. The questions described in this manuscript are in Tables 3.1-3.3. The final complete survey with additional descriptive questions is available upon request.

3.5.2 Expert Review

Six pharmacy experts from the UK and Canada reviewed the initial survey draft and provided feedback from a policy perspective with attention to terminology, response burden, and sequence of questions. Experts suggested that the response scales for behaviour and belief questions be converted from a 7 to 5 point scale and the "very poor" to "very good fit" scale be converted to a "strong barrier" to "strong support" scale. Additional feedback was gathered on questionnaire flow and length.

3.5.3 Cognitive Interviews

Ten pharmacists (three from community pharmacy, three from hospital practice, two in primary care or ambulatory team practice, and two from continuing care) participated in cognitive interviews for survey feedback. Overall, they took on the role of interpreting the survey as a pharmacist who would work in their current setting. They were not expected to interpret the survey or provide feedback on settings other than their own. This resulted in clarified

terminology, expanded response options, verified understanding of intended constructs, standardized recall periods, and removed or revised unclear response options and questions. The Alberta College of Pharmacists' categories of prescribing (e.g., adapt, provide emergency supply, or initiate/manage therapy) was repeated throughout the survey to ensure consistency and clarity. Questions on the innovation from Pronk,(13) adopter receptivity to change,(12) and influences on "not prescribing" were removed, as they were problematic for respondents. Belief response scales were reverted to 7-point scales to allow for more options. Finally, the survey was routed to ensure pharmacists who did not provide patient care did not answer questions on self-efficacy.

3.5.4 Pilot Survey

The pre-incentive letter was sent to 100 pharmacists. Two pharmacists were deemed ineligible (self-reported ineligibility to participate due to retirement and health reasons). Fifty-six pharmacists completed the online survey and 52 pharmacists provided direct patient care. The response rate for this pilot study was 57.1%. The telephone reminder prompted up to 14 pharmacists (25% of final respondents) to complete the survey; the telephone survey was retained in the final survey. Based on the research team's review of the pilot data, the research team refined ambiguous questions and identified question routing issues based on respondent characteristics. To ensure all scales had sufficient items, three questions were added to support for prescribing (i.e., confidence, documentation, and employers' expectations) and two items were added to the prescribing belief scale (i.e., avoid physician and extend one refill only). Upon inspection of responses, three redundant items were removed from the impact on practice (i.e., time with physicians, time and quality of relationships with other health care professionals) and one item on physician's responsibility for medication supply was removed.

3.5.5 Main Survey

Of the 700 pharmacists who were invited on April 19, 2013, eight were deemed ineligible (e.g., not renewing their practice license) for a total of 692 eligible pharmacists. After the third e-mail reminder, contact with a telephone reminder was made by the second call attempt for the majority of the pharmacists (n=331; 84.0%) with 225 (57.1%) going on to completing the interview (Figure 3.1). Three hundred and seventy-eight pharmacists completed the online survey for a response rate of 54.6%. Pharmacists were predominately female (71.2%), full-time (67.5%), working in a community pharmacy (76.7%), and working in larger urban centres (57.3%); 14% earned their initial pharmacy degree outside of Canada.(14)

During the telephone reminder, 40 (46.5%) of the 86 pharmacists who did not intend to do the online survey agreed to answer ten questions on their prescribing in the telephone reminder interview. Of the 40 of 86 pharmacists who did not intend to do the online survey but completed the brief telephone questions, one had APA (2.5%) and 34 (85%) prescribed in the last year in comparison with 6.3% and 93% of online respondents respectively.(9) These pharmacists used prescribing in multiple ways with 34 (100%) prescribing for continuity of care and 30 (82.4%) prescribing to adapt therapy which again were similar to the main survey with 93.4% and 80.6% respectively.(9)

3.5.6 Factor Analysis

Exploratory factor analysis of self-efficacy belief, support from practice, impact on practice, prescribing belief scales and electronic health record use resulted in eight factors (Table 3.4). Six questions on self-efficacy belief scale loaded on one factor with Cronbach's alpha >0.70 and represented pharmacists' self-efficacy toward prescribing. (Table 3.1) Two reliable factors from nine questions on support from practice were identified- practice environment (i.e., five

questions) and interprofessional relationships (i.e., two questions). (Table 3.2) Two items were dropped as they had low factor loadings and conceptually did not fit with the other practice environment items. There were nine questions about the impact on practice, and three questions were excluded due to weak correlation with other scale questions. (Table 3.1) The remaining questions loaded on two factors - professionalism and patient care having three questions each. Two out of five questions on prescribing belief were correlated weakly with other questions (<0.30). (Table 3.2) The remaining three questions loaded on one factor representing prescribing beliefs (Cronbach's alpha = 0.58) (Table 3.4). There were five questions about use of electronic health record which loaded in two factors.(Table 3.3) Two questions loaded on technical use (Cronbach's alpha = 0.51) and rest of the three questions loaded in use for patient care. (Cronbach's alpha = 0.80) (Table 3.4)

3.5.7 Description of Scales

Pharmacists' self-efficacy toward prescribing was moderate, with a mean of 2.66 and a standard deviation of 0.66 on a five-point scale. Looking at questions on the impact of prescribing on practice, pharmacists reported prescribing increased both patient care (mean =3.95, SD=0.11) and professionalism (mean =3.72, SD=0.39). Both practice environment (mean=3.52, SD=0.37) and interprofessional relationships (mean =3.41, SD=0.10) had a mean score between no impact and weak support for pharmacists' adoption of prescribing. Respondents with and without a patient care practice (n=378) scored a mean of 5.09 and a standard deviation of 0.71 on the prescribing beliefs on a seven-point scale meaning overall they agree with reasons to avoid prescribing. Pharmacists reported using the electronic health record occasionally for both technical (3.90 SD=0.11) and patient care (3.88 SD=0.32) purposes.

3.6 Discussion

A survey instrument was developed to explore factors impacting pharmacists' adoption of prescribing. The instrument had 27 questions with five scales with related six subscales: self-efficacy, support from practice (i.e., subscales: practice environment and interprofessional relationship), impact on practice (i.e., Subscales: professionalism and patient care), prescribing beliefs, and use of the electronic health record (i.e., Subscales: technical and patient care). Prescribing beliefs and use of the electronic health record for patient care had limited evidence for validity and reliability while the remaining six subscales had strong evidence for reliability and validity. The prescribing beliefs scale items only predicted 33% of the variance; whereas other scales explained between 57% and 70% of scale variance.

The prior qualitative research on the use of prescribing in Alberta allowed for the selection of meaningful constructs to measure factors impacting prescribing and language to richly describe how pharmacists came to understand and incorporate prescribing into patient care. First, the practice environment shaped patient care which in turn shaped pharmacists' use of prescribing and prescribing itself did not drive practice change.(5) Thus, questions related to the practice setting support, use of the electronic health record and benefits in the environment were included. Second, prescribing belief questions on the importance of the patients' responsibility to ensuring a sufficient supply of medications as well as the belief that pharmacists should only extend refills once came directly from the pharmacist interviews.

Expert stakeholder interviews ensured the ranges of factors which influence practice were operationalized. Pharmacist cognitive interviews provided evidence for face validity as well as the understandability and readability of the questions. Confusion over the definition of prescribing during the cognitive interview reflected the findings that pharmacists had a diverse

and context-specific definition of prescribing.(4,15) Consequently, the definition of prescribing was repeated throughout the survey.

Low response rates for surveys of healthcare professionals are common. (16,17) Recent response rates for pharmacist surveys in Canada have been reported at 10%,(18) 13%,(19) and 23%.(20) Our higher response rate of 57% and low level of dropouts may be explained using social exchange theory which posits that pharmacists will weigh the rewards, costs, and their trust toward the researchers when deciding to participate in a survey.(17,21) Rewards were provided in the form of a monetary incentive, asking for pharmacist opinions whether they prescribe or not, and informing pharmacists that they were randomly selected to participate.(22) The costs to pharmacists were reduced by e-mailing personalized links, ensuring responders were not contacted for follow-up, and tailoring questions to respondents (i.e., practice setting and prescribing status) to reduce questions not applicable to a respondent. The incentive and invitation letter were provided in advance via post to increase trust. Finally, the use of both telephone and e-mail reminders served to increase the response rate. Available information from non-responders who agreed to complete a brief telephone survey found similar prescribing behaviours.

The item analysis generated evidence for scale validity and reliability. Exploratory factor analysis allowed for the removal of items with weak scale ties and confirmed the structure of the scales; thus providing evidence for the construct validity. The prescribing beliefs and use of the electronic health record for patient care had insufficient validity and will require the future addition of items or revisions of existing questions. For example, the item “Pharmacists should only extend refills once” had lower loading on prescribing beliefs’ scale and may be dropped if

further analyses confirm an inadequate fit. The remaining six subscales had strong evidence for reliability and validity.

With careful attention to survey design as well as funding for survey incentives, survey research can produce a reasonable response rate. The proliferation of online survey tools has made surveys an accessible research tool and given a false illusion that conducting a survey is straightforward. Careful consideration of survey development, design, psychometric properties, and recruitment is time-consuming, yet has remained critical to ensure representative results.

As these are original scales for nascent prescribing activities, direct comparisons are not available. Pharmacists' self-efficacy was moderate and similar to that of pharmacists' adoption of new smoking cessation services.(23) Pharmacists reported feeling that prescribing increased both professionalism and patient care in their practice with similar findings in qualitative research.(24,25) Practice environment and physician relationships are common barriers to prescribing.4,26) Yet, pharmacists reported between no impact and weak support which was more positive than anticipated. Pharmacists in this study had up to six years to experience prescribing and may have found ways to collaborate with physicians or conversely physicians may have become accustomed to pharmacist prescribing. Pharmacists' use of the electronic health record appeared in line with our prior work on pharmacists' adoption of this system.(27)

A survey tool was developed to measure factors which may influence pharmacists' adoption of prescribing including self-efficacy, impact on practice, supports, and potential prescribing beliefs. As prescribing models in Canada, the UK, United States, and other countries vary; this tool may need adaptation to local needs. Findings from future research may inform interventions aimed at increasing adoption as a means of enhancing direct patient care by pharmacists.

3.6.1 Limitations

This study has several limitations which should be considered when extrapolating these results. Pharmacists in Alberta have a broad range of prescribing activities which allowed for the efficient study of multiple prescribing models, but this may limit generalizability to other jurisdictions. The prescribing beliefs scale has low reliability, and further research is needed to develop this scale. The incentive was not randomized; thus the response rate cannot be directly attributed to the incentive. Finally, these findings are from a 2013 survey, so while the tool is applicable, the findings represent the adoption of prescribing at that time.

3.7 Conclusion

Engagement of stakeholders, experts, and pharmacists contributed to the creation of a 27 item measure of factors impacting pharmacists' prescribing: self-efficacy toward prescribing, prescribing beliefs, support from practice, use of the electronic health record and benefits to practice. A high response rate was achieved with the use of a pre-survey incentive and online survey administration results in the efficient tailoring of the survey navigation for each participant. The prescribing beliefs and use of the electronic health record had some evidence for validity and reliability while the remaining six subscales had strong evidence for reliability and validity. This survey may help researchers, policy-makers, and educators understand what influences the uptake of prescribing and allow for the development of sound, evidence-based method interventions to enhance adoption of prescribing and improving patients' access to care.

3.8 References

1. Hill JD, Hill JM, Gentile NJ. A review of state pharmacist collaborative practice laws. *Am J Health Syst Pharm*. 2016;73(18):1467-1472.

2. Lim RHM, Courtenay M, Fleming G. Roles of the non-medical prescribing leads within organisations across a strategic health authority: Perceived functions and factors supporting the role. *Int J Pharm Pract*. 2013;21(2):82-91.

3. Law MR, Ma T, Fisher J, Sketris IS. Independent pharmacist prescribing in Canada. *Can Pharm J (Ott)*. 2012;145(1):23.e1.

4. Weiss MC, Sutton J. The changing nature of prescribing: Pharmacists as prescribers and challenges to medical dominance. *Sociol Health Illn*. 2009;31(3):406-421.

5. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Yuksel N. Factors influencing pharmacists' adoption of prescribing: Qualitative application of the diffusion of innovations theory. *Implement Sci*. 2013;8:109.

6. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Q*. 2004;82(4):581-629.

7. Tabachnick BG, Fidell LS. Using multivariate statistics. 5th ed. Boston: Pearson/Allyn and Bacon; 2007:646.

8. Bland JM, Altman D,G. Statistics notes: Cronbach's alpha. *Br Med J.* 1997;314(7080):572.

9. Guirguis LM, Hughes CA, Makowsky MJ. Sadowski CA, Schindel TJ, Yuksel N. Survey of pharmacist prescribing practices in Alberta. *Am J Health Syst Pharm*. 2017;74(2):62-69.

10. Guirguis LM, Makowsky MJ, Hughes CA, Sadowski CA, Yuksel N. How have pharmacists in different practice settings integrated prescribing privileges into practice in alberta? A qualitative exploration. *J Clin Pharm Ther.* 2014;39(4):390-398.

11. Latter S, Maben J, Myall M, Young A. Evaluating nurse prescribers' education and continuing professional development for independent prescribing practice: Findings from a national survey in england. *Nurse Educ Today*. 2007;27(7):685-696.

12. Westrick SC, Mount JK. Impact of perceived innovation characteristics on adoption of pharmacy-based in-house immunization services. *Int J Pharm Pract*. 2009;17(1):39-46.

13. Pronk MCM, Blom ATG, Jonkers R, Rogers EM, Bakker A, de Blaey KJ. Patient oriented activities in Dutch community pharmacy: Diffusion of innovations. *Pharm World Sci*. 2002;24(4):154-161.

15. Hughes CA, Makowsky M, Sadowski CA, Schindel TJ, Yuksel N, Guirguis LM. What prescribing means to pharmacists: A qualitative exploration of practising pharmacists in Alberta. *Int J Pharm Pract*. 2014;22(4):283-291.

16. Cook JV, Dickinson HO, Eccles MP. Response rates in postal surveys of healthcare professionals between 1996 and 2005: An observational study. *BMC Health Serv Res.* 2009;9(1):160.

17. Burke M, Hodgins M. Is 'dear colleague' enough? improving response rates in surveys of healthcare professionals. *Nurse Res.* 2015;23(1):8.

18. Yuksel N, Hughes CA, Schindel TJ, Daniels J, Varnhagen S. Pharmacists' self-described professional role: A shift in emphasis. *Can Pharm J (Ott)*. 2015;148(4):S2.

19. Patel T, Chang F, Mohammed HT, Raman-Wilms L, Jurcic J, Khan A, et al. Knowledge, perceptions and attitudes toward chronic pain and its management: A cross-sectional survey of frontline pharmacists in Ontario, Canada. *PLoS One*. 2016;11(6):e0157151.

20. Tsao NW, Lynd LD, Gastonguay L, Li K1, Nakagawa B1, Marra CA. Factors associated with pharmacists' perceptions of their working conditions and safety and effectiveness of patient care. *Can Pharm J (Ott).* 2016;149(1):18-27.

21. Dillman DA, Christian LM, Smyth JD. Internet, mail, and mixed-mode surveys. 3rd ed. Hoboken, NJ: Wiley; 2009:15.

22. Pit SW, Vo T, Pyakurel S. The effectiveness of recruitment strategies on general practitioner's survey response rates - a systematic review. *BMC Med Res Methodol*. 2014;14(1):76.

23. Martin BA, Bruskiewitz RH, Chewning BA. Effect of a tobacco cessation continuing professional education program on pharmacists' confidence, skills, and practice-change behaviors. *J AmPharm Assoc.* 2010;50(1):18a.

24. Tann J, Blenkinsopp A, Grime J, Evans A. The great boundary crossing: Perceptions on training pharmacists as supplementary prescribers in the UK. *Health Educ J.* 2010;69(2):183-191.

25. Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int J Pharm Pract.* 2009;17(2):89-94.

26. Lloyd F, Parsons C, Hughes CM. 'It's showed me the skills that he has': Pharmacists' and mentors' views on pharmacist supplementary prescribing. *Int J Pharm Pract.* 2010;18(1):29-36.

27. Hughes CA, Guirguis LM, Wong T, Ng K, Ing L, Fisher K. Influence of pharmacy practice on community pharmacists' integration of medication and lab value information from electronic health records. *J Am Pharm Assoc*. 2011;51(5):591-598.

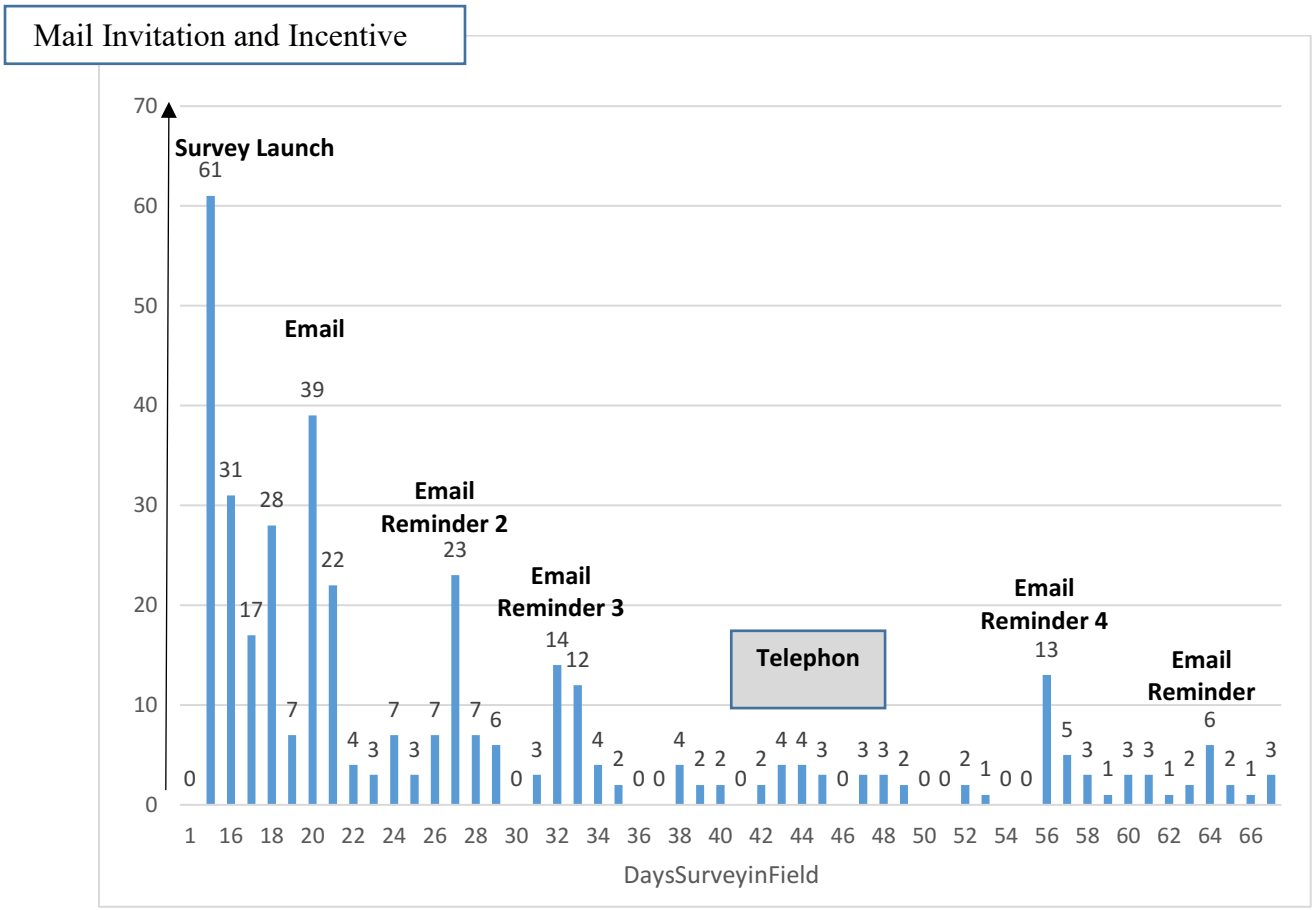

Figure 3.1 Number of Completed Online Survey by Days in Field and Data Collection Procedure

Table 3.1 Pharmacist Responses for Self-efficacy and Impact on Practice Items

	N	Mean	SD	Scale Mean (SD)
Self-Efficacy Beliefs* How sure are you that you could:				
perform a patient assessment to prescribe?	324	3.10	1.12	Prescribing Self-efficacy 2.66 (0.66)
prescribe in a clinical area that you are familiar with?	323	3.35	1.04	
prescribe in a clinical area that you are not familiar with?	326	1.65	0.90	
adapt a prescription for patients starting a new therapy?	323	2.61	1.19	
initiate new therapy for a patient?	323	2.13	1.13	
accept responsibility for medication management?	325	3.10	1.11	
Valid N (listwise)	318			
Impact on Practice** To what extent has prescribing impacted the following for you,				
Job satisfaction?	324	3.87	0.74	Professionalism 3.72 (0.39)
Professional image?	323	4.02	0.63	
Quality of physician relationship?	324	3.27	0.69	

Time spent with patient?	324	3.82	0.62	Patient Care 3.95 (0.11)
Time spent assessing patients?	325	4.02	0.59	
Quality of patient care?	325	4.00	0.59	
Overall workload?	325	4.18	0.60	Removed
Personal financial reimbursement?	324	3.02	0.42	
Need for continuing professional development?	325	4.10	0.64	
Valid N (listwise)	321			

*Response options: 1=Not sure at all, 2=Slightly sure, 3=Somewhat sure, 4=Rather sure, 5=Quite sure, 6=Very sure, 7=Extremely sure

** Response options: 1=Greatly decreased, 2=Decreased. 3=Same, 4=Increased, 5=Greatly increased

Table 3.2 Pharmacist Responses to Support and Prescribing Belief Items

	N	Mean	SD	Scale Mean (SD)
Support* To what extent do the following factors affect your prescribing activities:				
Pharmacy staffing at my practice location?	325	3.10	1.32	Practice Environment 3.52 (0.37)
Access to patient information?	326	3.83	1.27	
My practice environment?	323	3.55	1.30	
Patient expectations?	323	3.59	1.12	
Employer's expectations?	322	3.71	1.14	
Relationships with physicians?	325	3.34	1.17	Interprofessional Relationships 3.41 (0.10)
Relationships with other health care professionals?	325	3.47	0.99	
My education and training?	323	3.94	1.24	Removed
Requirement to document patient care?	323	2.95	1.26	
Valid N (listwise)	312			
Prescribing Beliefs**				
Patients are responsible for ensuring they have a sufficient supply of medications?	373	5.28	1.01	Prescribing Beliefs 5.09 (0.71)
Pharmacist prescribing increases pharmacists' professional liability?	375	5.68	1.09	

Pharmacists should only extend refills once?	375	4.30	1.42	
Pharmacist prescribing is an extension of the role that pharmacists already fulfill?	376	5.38	1.10	Removed
Pharmacist prescribing helps patients avoid physician follow-up?	376	3.56	1.39	
Valid N (listwise)	371			

*Response options: 1=Strong barrier, 2=Weak barrier, 3=Not a factor, 4= Weak support. 5=Strong support

** Response options: 1=Completes disagree, 2=Strongly disagree, 3=Disagree, 4=Neither disagree nor agree, 5=Agree, 6=Strongly agree, 7=Completely agree

Table 3.3 Pharmacist Responses to purpose of using EHR*

	N	Mean	SD	Scale Mean (SD)
Use of EHR** (Netcare) To look up:				
Demographic information including personal health care numbers (number from Alberta Health card)	333	3.83	1.22	Technical Use 3.90 (0.11)
Double doctoring or multiple pharmacies	332	3.98	0.96	
Medical history such as diagnostic tests and discharge or admission history	335	3.52	1.28	Patient Care 3.88 (0.32)
Lab values	337	3.98	1.12	
Medication history/allergies/refills including Pharmaceutical Information Network	337	4.13	0.90	
Valid N (listwise)	323			

*Response options: 1=Not at all, 2=Rarely, I use another system, 3=Rarely, 4= Occasionally, 5=Routinely

**Electronic Health Record

Table 3.4 Factor analysis

Scale	Number of items	Kaiser – Meyer – Olkin	Number of Removed items*	Factors having >1 Eigenvalue	Subscales and number of loaded items	Explained variance (%)	Cronbach's alpha
Self-efficacy	6	0.85	0	1	Prescribing Self-Efficacy(6)	65	0.89
Support from Practice	9	0.85	0	2	Practice Environment (5)	41	0.78
					Interprofessional Relationships (2)	10	0.85
Impact on Practice	9	0.74	3	2	Professionalism (3)	49	0.76
					Patient Care (3)	22	0.78
Prescribing beliefs	5	0.61	2	1	Prescribing Beliefs (3)	33	0.58
Use of EHR**	5	0.67	0	2	Technical Use (2)	27	0.51
					Patient Care (3)	43	0.80

* Removed due to due to weak correlation (<0.3) with other scale items

**Electronic Health Record

Chapter Four

Characterizing pharmacist prescribers in Alberta using cluster analysis

Chowdhury F. Faruquee, Ken Cor, Christine Hughes, Mark Makowsky,

Cheryl Sadowski, Theresa Schindel, Nese Yuksel, Lisa M. Guirguis

4.1 Abstract

Background: Canadian pharmacists are now authorized to practice different types of prescribing in different provinces. Our objective was to characterize Albertan pharmacists into different prescriber groups and to compare the groups according to their practice settings, the proportion of Additional Prescribing Authority (APA) pharmacists, and support experiences.

Methods: Data was collected from the sample of 700 practicing registered pharmacists in Alberta in 2013 exploring the adoption of pharmacist prescribing. A cross-sectional survey was used to identify the pharmacists' involvement in different types of prescribing activities, their practice settings and support experiences. Cluster analysis was used to group participants based on their reported prescribing practices and Chi-Square tests and one-way ANOVA were used to compare prescriber groups by practice settings, the proportion of APA pharmacists, and support experiences respectively.

Results: Three groups of pharmacist prescriber were identified including "Renewal prescriber"(74%), "Modifier"(17%), and "Wide ranged prescriber"(9%). Prevalence of "Renewal prescriber" in the community setting was 85.8% whereas "Modifier" was predominant (66.7%) in the collaborative setting. Higher support experience facilitated the wide ranged prescribing. Smallest proportion (3.1%) of APA pharmacists was found in the "Renewal prescriber" group.

Conclusion: Albertan pharmacists were practicing different types of prescribing in different extent. Cluster analysis was helpful to classify them into groups according to their prescribing types. The prevalence of these prescriber groups in different practice settings, the proportion of

APA pharmacists in these groups, and their level of support experience provided evidence of the validity of these groups' prescribing characteristics.

4.2 Introduction

Canadians were expected to spend 11.1% of total gross domestic product on health care in 2016 (1) and healthcare expenditure varies among provinces in Canada.(2) Alberta spends the highest amount on health care, and Albertans will pay more than double in next 10 years if the trend of health care cost remains the same.(2) Despite increasing health care costs, accessing health care and wait times remain a problem for many Canadians. Sixty-two percent of Canadians reported difficulties in seeing a doctor or a nurse on the same day.(3) Alberta is also one of the top three provinces where people have the longest wait to see a doctor or nurse on the same day, after hours, and on weekends.(3) On the contrary, the number of physicians is not increasing at the same pace as the population demands.(2) However, a partial delegation of preventive and chronic care services from a physician to non-physician member of a healthcare team is an effective modification of the health care system that can lead to improved access to health care service in a cost-effective manner and strengthen the healthcare service.(4-6)

Pharmacists are one of the most accessible primary healthcare providers who are knowledgeable about medications.(7) Legislative and regulatory bodies in Canada have expanded pharmacists' scope of practice in different provinces. Pharmacists are now involved in many medication-related health services to help patients manage medication safely and cost-effectively. Across Canada, pharmacists are now authorized to practice different types of prescribing in different provinces.(8) Consequently, it is expected that the wait time to see health care providers will be reduced, patients will have enhanced access to healthcare services, and primary health care services will become efficient with all these practice changes.

Alberta was the first jurisdiction in Canada to authorize pharmacist prescribing in 2007.(9) Several timely and positive influences played a part which included a review of scope of practice for all healthcare providers in the Health Professions Act, support from the Alberta College of Pharmacists (ACP), a strong platform of pharmacists' knowledge and skill, independent research, healthcare providers' collaboration, and a requirement for timely and fair access to health care services.(7) Pharmacists in Alberta are authorized to carry out three categories of prescribing of prescription drugs, which does not include narcotic and controlled drug (e.g. opioids and its derivatives, barbiturates, and benzodiazepines).(9) The first category is adapting a prescription, which includes altering dose and substituting a drug within the same therapeutic class of new prescriptions and prescribing for the continuation of therapy. (9) In the second category, pharmacists can prescribe under emergency conditions when a patient is unable to reach a physician or other authorized prescriber but needs immediate therapy. (9) Finally, pharmacists with Additional Prescribing Authority (APA) can initiate a new prescription after appropriate assessment within their limit of competency at the initial point of access or in collaboration with another health care provider. (9) To receive APA, pharmacists have to submit a comprehensive application package that provides evidence of quality patient care.(10)

Pharmacists are practicing different types of prescribing in Canada, and there have been notable discussions in the literature regarding pros and cons of this expanded scope of practice. Researchers have focused on different areas of pharmacist prescribing to examine and explore, such as the consequences of pharmacist prescribing, perceptions of various stakeholders, the evolution of pharmacy practice, and changes in regulation.(11) However, little is known about pharmacists' prescribing adoption and complexity of practice change evolving around prescribing adoption. Researchers in Alberta have been studying pharmacist prescribing since

2009 through a multistep project. Our research team started with a qualitative study and interviewed pharmacists in Alberta to understand the complex nature of pharmacist prescribing adoption.(12,13) This qualitative research suggested that Albertan prescribers adopted different types of prescribing activities (i.e. altering dose, substituting a drug, renewing or continuing existing therapy, initiating therapy, prescribing in an emergency) to different extents which were influenced by several factors.(12-14) The practice setting, as well as supports from the practice setting, were reported as key factors that could affect the adoption.(12-14) Characterizing the pharmacists based on their level of prescribing adoption, their prevalence in different practice settings and their experience of supports from practice setting will provide guidance for policy-makers and researchers to understand the adoption process.

4.3 Objectives

In this study our objective is the secondary analysis of a survey data to i) characterize Albertan pharmacists by clustering them into different groups according to their prescribing practice, ii) to compare these groups by practice settings, the proportion of APA pharmacists, and support from the practice environment.

4.4 Methods

4.4.1 Research Design

Our research team developed and administered a survey to explore pharmacist prescribing adoption in Alberta quantitatively.(14) The survey methodology and descriptive results was published. (14) The survey explored the involvement of pharmacists in different types of prescribing activities, their practice settings and experience of supports from practice environment. In this project, cluster analysis (15,16) was used to characterize pharmacists using their prescribing practice and they were grouped accordingly. We also compared the groups by

their practice setting, support experiences, and APA. This study was approved by the Health Ethics Research Board Panel B, University of Alberta.

4.4.2 Participants and procedures

The instrument was developed based on the conceptual model, existing literature, Diffusion of Innovation (DoI) theory and the findings from the interviews of 38 Albertan pharmacists. (12-14) The survey questions were tested for validity three stages. Details of survey development were published in Guirguis LM et.al. (2017).(14) The final cross-sectional survey was administered to a random sample of 700 practicing registered pharmacists in Alberta from April 19, 2013, to June 10, 2013. (14)

4.4.3 Characterizing pharmacists according to their prescribing practices

We used cluster analysis, a multivariate technique, to group participants based on their reported prescribing practices. (15,16) We characterized pharmacist prescribers using their responses to the question comprising eight items asking about the proportion of their patients for whom they performed different types of prescribing activities in practice in the last month. We included all the types of prescribing activities approved in Alberta such as emergency prescribing, prescription adapting, substituting, renewing, and initiating. These questions were designed as seven points Likert scale starting from "None" to "All" (1= none, 2=few, 3=less than half, 4=half, 5=more than half, 6=most, 7=all). Participants with high scores in these questions were considered as more frequent prescribers. We used standardized score (i.e. Z-score) for the analysis for better interpretation of the results.

We used k-means (i.e. non-hierarchical) cluster analysis to group the pharmacists based on the similarities and dissimilarities in their responses to the question exploring their practice of

different types of prescribing. In the end, all the participants were represented by their cluster number.(16) After assigning the cluster number to each participant, two researchers independently analyzed the clusters according to their attributes or pattern of prescribing activities and came to an agreement about naming the clusters.

We removed all the outliers who had score on questions about the types of prescribing that were beyond the three interquartile range. We used multiple imputation methods to handle missing values (i.e. missing responses to questions on types of prescribing) before running the cluster analysis to minimize the sensitivity issue of this analysis. After running cluster analysis, we also ran ANOVA and subsequent Tukey test with a confidence interval of 0.05 to observe significant contribution of each item in clustering procedure. Furthermore, to establish stable clusters we measured the distances between the cluster centers and also the distances of participants from the cluster center to identify any outliers of the clusters. Greater distances between the cluster centers represent greater dissimilarities between the clusters and absence of outliers within clusters signifies less variability and more consistency among group members.

4.4.4 Group Comparisons by Practice Setting, Proportion of APA, and Environmental Support

Two main independent variables were used to explore the secondary outcomes, namely the relationships with the practice setting and environmental support. We measured practice settings using responses to the question asking about their location of practice. We classified the practice setting using 12 different practice locations. We removed participants who were involved in teaching /academic work location due to lack of prescribing scope. Considering the practice manner and interprofessional collaboration possibilities, we grouped the practice settings into two groups. We collapsed large grocery/box store, chain community, franchise

community, hospital outpatient pharmacies, and independent community pharmacies as "Community setting" and primary care network, home care facility, physician's office, ambulatory care setting, long-term care, and hospital inpatient as "Collaborative setting". Therefore, there were two levels under "practice settings" variable. We used Chi-Square test with a confidence interval of 0.05 to measure whether there are significant differences in the presence of different clusters of pharmacists between the community and collaborative practice settings. We also compared the proportion of APA pharmacists of these groups using Chi-Square test.

For environmental support, we used responses to the question containing nine items about different factors, such as pharmacy staffing, access to patient information, patients' and employers' expectations, practice environment, relationship with physicians and other healthcare professionals, documentation process of care, education and training as support or barrier to measure the support from practice environment. These questions were designed as five points Likert scale from "Strong barrier" to "Strong support" (1= strong barrier, 2=weak barrier, 3=not a factor, 4=weak support, 5=strong support). We calculated the mean of the responses of nine items to measure the extent of practice environmental support. Participants with high scores on these questions were considered as having greater perceived environmental support to adopt prescribing and vice versa. We ran one-way ANOVA with a confidence interval of 0.05 to measure significant differences among clusters of pharmacists (i.e. dependent variable) while comparing their perceived support experience (i.e. continuous independent variable) from practice environment. Before running ANOVA, we tested the assumptions of normality, the presence of outliers, and homogeneity of variances (i.e. Levene's test).

4.5 Results

In total, 378 (i.e. 54%) pharmacists completed the survey. The number of participants involved in different types of prescribing activities is 327. After removing 12 outliers and 12 participants with missing data, we had 303 participants for further analysis to answer our research questions (Figure 4.1). The sample was 69.7% female participants, 81.2% in the community settings, and 57.9% in the large urban area. Among the participants 71.3% were working as full-time, 34.7% had their Canadian license between the years of 2000 to 2009, and 6.6% pharmacists were APAs (Table 4.1).

4.5.1 Pharmacists' Prescribing Behaviour

We grouped the participant pharmacists according to their types of prescribing practice using six out of eight items of the question. We did not include two items about initiating new prescription which were answered by pharmacists with APA only. As the number of APA pharmacists in our study was low in comparison to the total participants, the inclusion of these two items may pose biases in the analysis. But we included the responses of the APA pharmacists to the other items of the questions. We found three clusters after running the cluster analysis which is supported by previous qualitative research by our research team (Figure 4.2). (12) The stability of the clusters was examined by the convergence, outliers within clusters, Euclidean distances among the cluster centers, and involvement of items in the clustering process. Maximum convergence of zero was achieved after 16 iterations, and none of the clusters had any outliers in their groups providing the evidence of consistency among group members within clusters. The Euclidean distance between clusters varied from 2.50 to 4.63 which represented satisfactory dissimilarities among clusters. The resulting three clusters were characterized by their involvement in different types of prescribing.

4.5.2 Naming and characterizing clusters

We named and described all the clusters by the prescribing characteristics of the group of pharmacists as mentioned below.

4.5.2.1 Cluster 1: Renewal prescriber

Cluster one, consisting of 74% of the total participants, is the largest cluster. These pharmacists were primarily associated with renewal prescribing. Their involvement in all other types of prescribing was below the mean value. They were also involved in emergency prescribing to a small extent (Figure 4.2). Considering their prescribing practice pattern, we entitled this cluster as "Renewal prescriber" group.

4.5.2.2 Cluster 2: Modifier

We named the pharmacists of cluster two as "Modifier". This group of pharmacists (N=51; 17% of total participants) was mostly involved in modifying prescription by altering doses or regimen and substituting drugs within similar therapeutic classes (Figure 4.2). All these types of prescribing require assessment of disease condition, patients' organ function, and patients' age or other medical conditions at the initial encounter of new prescriptions. Their association with renewal prescribing, emergency prescribing, and substituting drugs prescribing due to lack of commercial availability was below the mean values.

4.5.2.3 Cluster 3: Wide ranged prescriber

Cluster three is the smallest one consisting of 9% of the total participants. The pharmacists in this cluster were involved in wide range of prescribing activities (Figure 4.2). Their association with altering doses, altering formulation, substituting medications due to lack of commercial availability of drug products, and substituting prescribing drug within similar therapeutic classes

was higher than their involvement in renewal and emergency prescribing. We named the pharmacists of this cluster as “Wide ranged prescriber.”

The three groups of prescribers contrasted significantly ($p<0.05$) from each-others by their involvement in emergency prescribing, altering dose prescribing, altering formulation prescribing and substituting drug with similar therapeutic effect prescribing. The “Modifier” was significantly different from “Wide ranged prescriber” and “Renewal prescriber” by their involvement in renewal prescribing ($p<0.05$). Whereas, “Wide ranged prescriber” was significantly different from “Renewal prescriber” and “Modifier” while they were involved in substitution prescribing activities due to lack of commercial availability of drug products ($p<0.05$). Therefore, all six items that we included in the cluster analysis were significantly ($p<0.05$) necessary to differentiate the groups.

4.5.3 Presence of the groups in different practice settings

A chi-square test of independence was performed to examine the relation between three clusters and two major practice settings (i.e. community and collaborative). The relation between these variables was significant, [X^2 (2, N = 303) = 130.49, p <.05]. “Renewal prescriber” was typically predominant (i.e. 85.8%) in the community setting both independent and chain. The greatest portion (i.e. 66.7%) of the “Modifier” was practicing in collaborative settings. “Wide ranged prescriber” was distributed in all of the practice settings but to a lesser extent compared to other groups (Figure 4.3).

4.5.4 Proportion of APA in the groups

The proportion of APA pharmacists was significantly different among these three groups, [X^2 (2, N = 303) = 16.86, p <.05]. “Renewal prescriber” group had smallest proportion of APA

pharmacists (i.e. 3.1%) within the group whereas the Modifier" group had the larger proportion of APA pharmacists within the group (i.e. 17.6%). "Wide ranged prescriber" had 13.8% of APA pharmacists within the group.

4.5.5 Relationship of the groups with their experience of supports from the practice environment

An analysis of variance (i.e. ANOVA) showed that pharmacists' experience of support from practice environment was significantly different among three clusters [$F(2,300) = 4.07$, $p = 0.02$]. Post hoc comparison using the Tukey HSD test indicated that the mean score of support experienced by "Wide range prescriber" [M=3.84, SD=0.76] was significantly (p=0.02) different from that score of "Renewal focused prescriber" [M=3.43, SD=1.00] (Figure 4.4). However, the experience of support from practice environment of "Wide range prescriber" and "Renewal focused prescriber" did not significantly differ from the "Modifier" group's experience of support. Therefore, these results suggested that pharmacists adopted a wide range of prescribing when they received high levels of support from the practice environment.

4.6 Discussion

In this study, we characterized the pharmacist prescribers in Alberta, their presence in different practice settings, and impact of support in adoption style. We found that even though almost 90% of participant pharmacists reported that they have adopted prescribing activities, about three-quarters were involved in renewal focused prescribing activities where they continued a medication which was previously prescribed by another authorized prescriber. Less than 20% of participants modified prescriptions which are substantially less than the renewal focused prescribing. The smallest group is the "Wide ranged prescriber", who practiced renewing, altering and substituting prescriptions. Additionally, we found that renewal focused prescribers

were primarily located in the community pharmacy settings and there were significant differences in the level of perceived support from practice for prescribing among the three groups. We also found that "Renewal prescriber" group had the smallest proportion and "Modifier" group had the highest proportion of the APA pharmacists.

The renewal prescriber is the most common group possibly because renewal prescribing is straightforward, requires less time, and ensures patient satisfaction. It also poses a low threat to the autonomy of the original prescriber. Our research group found in a qualitative study on pharmacists in Alberta that pharmacists tend to reduce prescribing activities due to worry about additional responsibilities and negative reaction from physicians.(12) Other research findings suggest that possible aversive outcome, alleged risk, physician's approval are associated with the anxiety of prescribing responsibilities.(17-19) Therefore, most of the pharmacists were more inclined to renewal prescribing than any other complex prescribing.

We found that "Modifier" practiced renewal focused prescribing significantly lower than other two groups. The majority of the pharmacists in the collaborative setting were "Modifier" as they had less opportunity to renew prescription due to distinct practice approach in hospital and consultancy settings. The patient does not ask for an extension of therapy to the pharmacist practicing in these settings. Renewal prescribing primarily is a phenomenon of the community setting. Reasonably, we found that most of the pharmacists in the community setting were "Renewal prescriber". Renewal prescribers practiced altering dose and regimen or substituting medication significantly lower than other two groups. The practice system in the community setting does not provide pharmacists with enough time and facilities to do a clinical assessment. Furthermore, in the acute care setting, patients are having medication changes more frequently, so there is plenty of opportunity of altering dose, the formulation for the hospital settings;

whereas, a patient in the community might have changed therapy yearly, or every three months according to their clinical outcome. A recent survey study on clinical pharmacists working in the critical care unit of the hospital in the UK similarly reported that pharmacist prescribing activities included organ function based dose adjustment, formulation and route of administration change, and prescribing error amendment.(20) In the hospital setting, there is a medication formulary, which restricts the option for physician prescribing. Consequently, pharmacists in this setting have less opportunity to change drug due to unavailability or shortage. Pharmacists in collaborative setting also have limited scope of prescribing in an emergency situation possibly because physicians and other healthcare providers with prescribing authority are available most of the time.

The proportion of "Wide ranged prescriber" was comparable in both community and collaborative practice settings. Our study suggests that this group of prescriber experienced significantly higher support from practice than the "Renewal prescriber". In previous studies on pharmacists in Canada and the UK reported that supporting factors such as sufficient access to patients' information, positive patients' expectation, collaborative relationship with physicians and other healthcare professionals, and adequate pharmacy staffing, influenced implementation of prescribing into practice.(12, 21, 22) Nonetheless, it is noteworthy that despite lack of support most of the pharmacists (i.e.,90%) adopted prescribing and moved out of the conventional "counting pill and dispensing" role of pharmacists.(23)

A further finding that could explain the prescribing characteristic of these groups was their proportion of APA pharmacists. APA pharmacists were expected to be open to any types of prescribing activities as they pursued additional prescribing authority. The smallest proportion of APA in the "Renewal prescriber" group validates their prescribing characteristics. On the

contrary, the highest proportion of APA pharmacists in the "Modifier" group could explain their prescribing types.

Comparisons between the practice setting, support experience, and APA status among the pharmacist clusters provided evidence of validity as our findings were consistent with the existing literature and anecdotal evidence.(12, 13, 20-22) However, each prescribing type is necessary as it serves patients' health care needs. Pharmacists are expected to be involved in more patient-centered care by incorporating their clinical knowledge and expertise as per the need. Improved access to health care and reduced physicians' burden could not be achieved if pharmacists failed to apply different types of prescribing into practice.

4.6.1 Strengths and limitations

Our study is the first to characterize pharmacists according to their reported prescribing activities. Our data captured information from a unique model of pharmacist prescribing in Alberta and our findings may not be generalizable to the pharmacists of other jurisdictions. However, Albertan pharmacists have the broadest scope of prescribing practice in Canada as well as in North America. Therefore, our findings will be beneficial for other jurisdictions and countries that are planning to implement and support adoption of pharmacist prescribing. Cluster analysis is descriptive and non-theoretical. Cluster solution depends on the variables used to characterize the groups. Therefore, there is a threat of external validity as the inference will only applicable for the participants of the study.(25) However, the group comparisons confirmed the anticipated characteristics of the clusters. Along with the findings of the group comparisons, evidence from literature provided evidence for the validity of the clusters.(13, 14, 21, 22, 24) The higher response rate (i.e. 54%) and large sample size of the study increased the statistical power of the analysis.

We did not include survey items capturing the responses relevant to initiating new prescriptions. Only APA prescribers answered these questions, and their participation in our survey was low compared to total participants. Therefore, we excluded items relevant to initiating new prescription to remove biases. We used multiple imputations to handle missing data. Further sensitivity test could be run to ensure that imputation did impact our findings. There were also possibilities of pharmacists confusing prescribing in emergency and renewing a prescription. Pharmacists might report their prescribing act as an emergency prescribing which could be renewing a prescription in an emergency situation for the patient.

4.7 Conclusion

Our study identified three main groups of pharmacist prescribers by considering the similarities and differences in the adoption patterns of various prescribing activities. The majority of the participants in a community setting were prescribing with a focus on renewing prescriptions whereas collaborative setting results in a greater number of pharmacists are adapting. Higher support from practice environment facilitated a higher level of adoption. Future research can be conducted to explore factors influencing the types of adoption and to measure shifting of prescribing type over time.

4.8 References

1. National Health Expenditure Trends, 1975 to 2016 (report 2016)
2. Healthcare Governance Models in Canada, Pre-Summit Discussion Paper, March 2013
3. Wait Times Database, 2013, CIHI; OECD Health Data 2015
4. Becoming the Best: Alberta's 5-Year Health Action Plan 2010

5. Altschuler J, Margolius D, Bodenheimer T, Grumbach K. Estimating a reasonable patient panel size for primary care physicians with team-based task delegation. *Ann Fam Med.* 2012;10(5):396-400.
6. Health System Efficiency in Canada: Why Does Efficiency Vary Among Regions? Canadian Institute for Health Information 2014
7. 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.
8. Pharmacists' Expanded Scope of Practice in Canada, Canadian Pharmacists Association. [Updated 2016 Dec; cited 2017 May 25]. Available from: http://www.pharmacists.ca/index.cfm/pharmacy-in-canada/scope-of-practice-canada/
9. Yuksel N, Eberhart G, Bungard TJ. Prescribing by pharmacists in Alberta. *Am J Health Syst Pharm*. 2008;65(22).
10. Guide to receiving Additional Prescribing Authorization, Alberta College of Pharmacists, 2nd Edition. [Updated 2013 Jan; cited 2017 May 25]. Available from: https://pharmacists.ab.ca/sites/default/files/APAGuide.pdf
11. Faruquee CF, Guirguis LM. A scoping review of research on the prescribing practice of Canadian pharmacists. *Can Pharm J (Ott).* 2015;148(6):325-48.
12. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Yuksel N. Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. *Implementation Sci*. 2013;8(1):109.
13. Guirguis LM, Makowsky MJ, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N. How have pharmacists in different practice settings integrated prescribing privileges into practice in Alberta? A qualitative exploration. *J Clin Pharm Ther.* 2014;39(4):390-8.

14. Guirguis LM, Hughes CA, Makowsky M, Sadowski C, Schindel T, Yuksel N. Survey of Pharmacist Prescribing Practices in Alberta. *Am J Health Syst Pharm*. 2017; 74:(2):62-69
15. Selim SZ, Ismail MA. K-means-type algorithms: A generalized convergence theorem and characterization of local optimality. *IEEE Trans Pattern Anal Mach Intell.* 1984;(1):81-7.
16. Khalid MN. Cluster analysis-a standard setting technique in measurement and testing. *JAQM*. 2011;6(2).
17. Rosenthal MM, Breault RR, Austin Z, Tsuyuki RT. Pharmacists' self-perception of their professional role: insights into community pharmacy culture. *J Am Pharm Assoc (2003).* 2011;51(3):363-8a.
18. Maddox C, Halsall D, Hall J, Tully MP. Factors influencing nurse and pharmacist willingness to take or not take responsibility for non-medical prescribing. *Res Social Adm Pharm*. 2016;12(1):41-55.
19. Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int J Pharm Pract*. 2009;17(2):89-94.
20. Bourne RS, Whiting P, Brown LS, Borthwick M. Pharmacist independent prescribing in critical care: results of a national questionnaire to establish the 2014 UK position. *Int J Pharm Pract*. 2016;24(2):104-13.
21. George J, McCaig DJ, Bond CM, Cunningham IS, Diack HL, Watson AM, Stewart DC. Supplementary prescribing: early experiences of pharmacists in Great Britain. *Ann. Pharmacother.* 2006;40(10):1843-50.

22. Auta A, Strickland-Hodge B, Maz J, Alldred DP. Pharmacist prescribing in the United Kingdom and the implication for the Nigerian context. *West Afr J Pharm*. 2015;26(1):54-61.

23. Kelly DV, Young S, Phillips L, Clark D. Patient attitudes regarding the role of the pharmacist and interest in expanded pharmacist services. *Can Pharm J (Ott)*. 2014;147(4):239-47.

Table 4.1 Demographics of Participant Pharmacists

Characteristics	Total Participant	Renewal prescriber	Modifier	Wide ranged prescriber
	Number of participants (%)	Number of participants (% within the group)	Number of participants (% within the group)	Number of participants (% within the group)
Total participants	303	223	51	29
Gender[a]				
Female	205 (69.7)	145 (66.5)	41 (83.7)	19 (70.4)
Male	89 (30.3)	73 (33.5)	8 (16.3)	8 (29.6)
Age group (years)				
≤30	79 (26.1)	54 (24.2)	15 (29.4)	10 (34.5)
31-60	208 (68.6)	155 (69.5)	34 (66.7)	19 (65.5)
60≥	16 (5.3)	14 (6.3)	2 (3.9)	0 (0)
Practice setting				
Community settings	246 (81.2)	211 (94.6)	13 (25.5)	22 (75.9)
Hospital/consultancy settings	57 (18.8)	12 (5.4)	38 (74.5)	7 (24.1)

Practice area[b]				
Large urban population centre (100,000 or greater)	175 (57.9)	124 (55.9)	36 (70.6)	15 (51.7)
Medium population centre (30,000 to 99,999)	46 (15.2)	31 (14.0)	6 (11.8)	9 (31.0)
Small population centre (1,000 to 29,999)	78 (25.8)	65 (29.3)	8 (15.7)	5 (17.2)
Rural (population less than 999)	3 (1)	2 (0.9)	1 (2.0)	0 (0)
Additional Prescribing Authorization (APA)				
APA	20 (6.6)	7 (3.1%)	9 (17.6%)	4 (13.8%)
a: Responded by 294 participants b: Responded by 302participants				

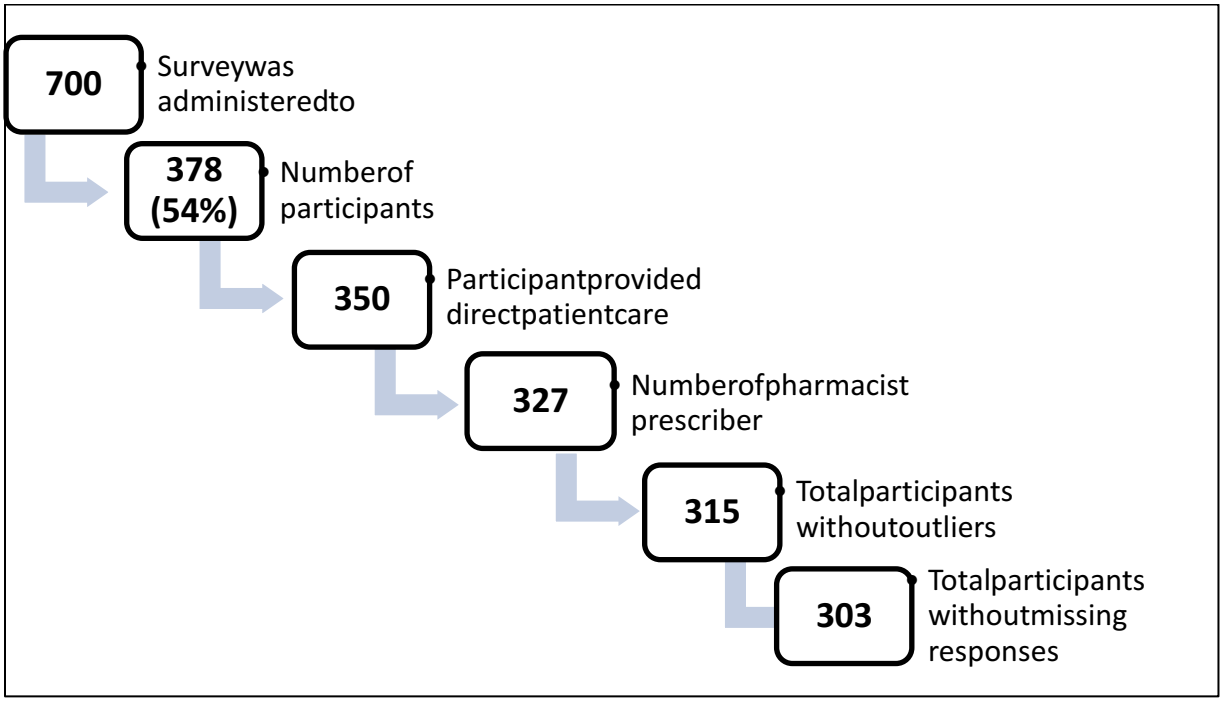

Figure 4.1 Flowchart describing participant inclusion process in the study

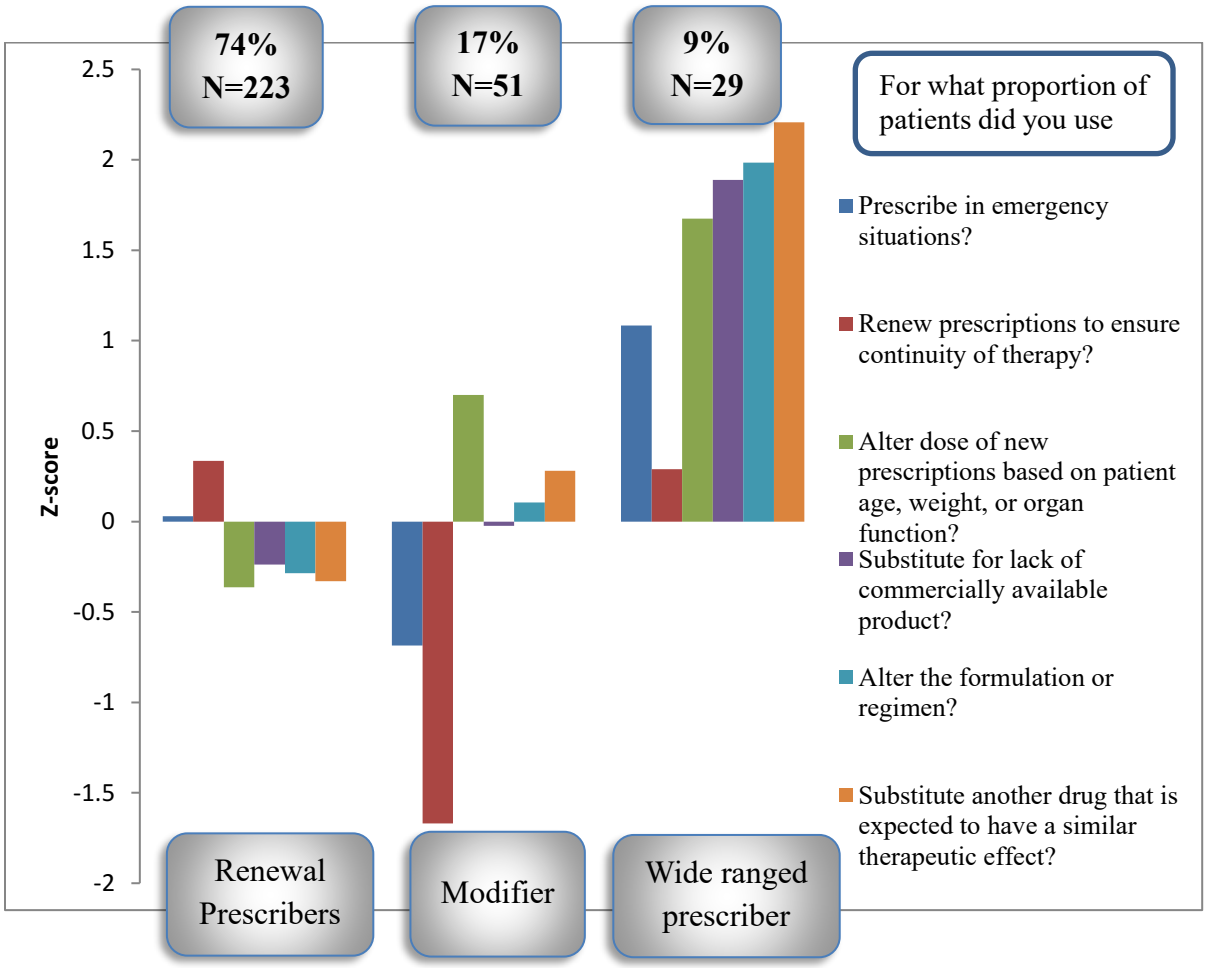

Figure 4.2 Groups of pharmacist according to their type of prescribing practice

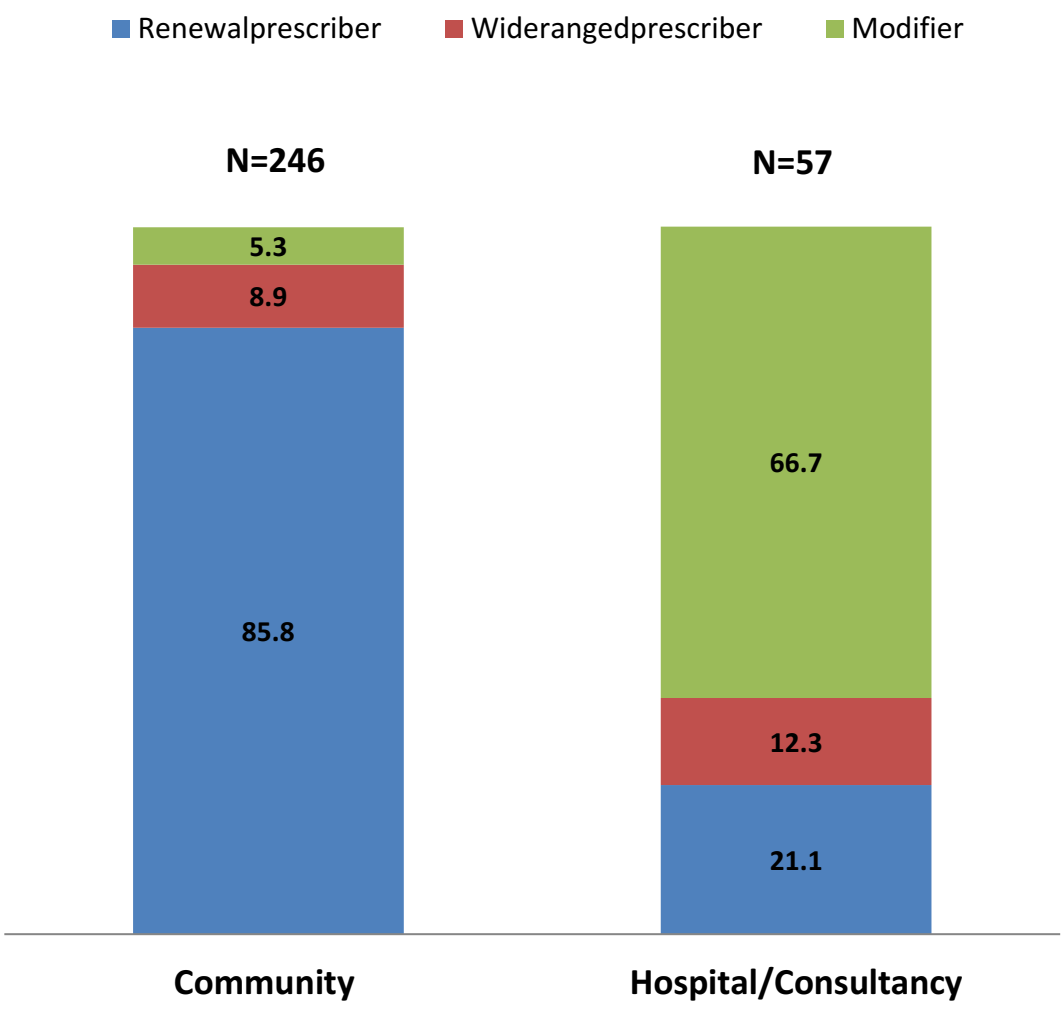

Figure 4.3 Presence (%) of prescriber groups in different practice settings

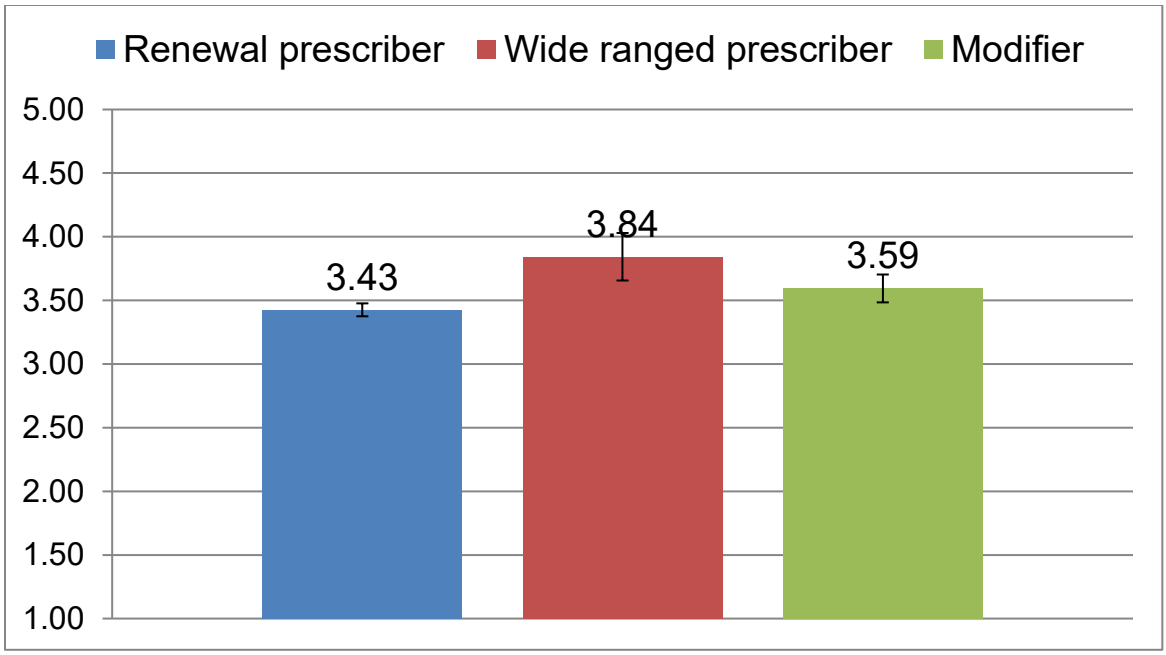

Figure 4.4 Level of support experience from practice in different groups

Chapter Five

Factors affecting pharmacist prescribing adoption

Chowdhury F. Faruquee, Ken Cor, Christine Hughes, Mark Makowsky,

Cheryl Sadowski, Theresa Schindel, Nese Yuksel, Lisa M. Guirguis

5.1 Abstract

Background: Pharmacists in Canada are authorized to prescribe as part of expanded scopes of practice with the expectation of enhanced patient access to healthcare services. Understanding the mode of adoption and factors facilitating the adoption process is important to translate prescribing into practice. Our objective was to explore the factors affecting frequency and types of pharmacist prescribing adoption by the guidance of diffusion of innovation (DoI), self-efficacy, and role belief theories.

Methods: A secondary analysis was planned for the cross-sectional survey data from practicing registered pharmacists in Alberta in 2013 with a 54% response rate. We measured the participants' demographic information using descriptive statistics. Hierarchical multivariate regression analysis and logistic regression analysis were used to predict the frequency of prescribing adoption and types (i.e. renewal focused and multifaceted prescriber) of pharmacist prescribing adoption respectively. Independent variables having correlation > 0.40 were removed to avoid multicollinearity. Variables were entered in three blocks using three features of DoI theory. The first block (i.e., system readiness) included practice setting and support from practice environment; Second block (i.e., pharmacists as adopter) included care intensity, self-efficacy beliefs, prescribing beliefs, and year of experience; Third block (i.e., prescribing as innovation) included the impact on patient care.

Results: In this sample, 6.7% had Additional Prescribing Authority (APA), 71.2% were female participants, and 77% were in community practice setting. An increase in the frequency of pharmacist prescribing was significantly predicted (R^2=0.14, $p<0.05$) by community practice setting, higher support from practice environment, an increase pharmacists' self-efficacy beliefs toward prescribing, and longer experience in practice. The logistic regression model was

statistically significant, ($p<0.01$) and explained 41.70% of the variance. Collaborative practice setting and higher self-efficacy belief significantly predicted multifaceted prescribing adoption ($p<0.01$).

Conclusion: System readiness and pharmacists' own features were important indicators of prescribing adoption in pharmacy practice. Combination of prescribing frequency and type gives more profound understanding of adoption compared to prescribing frequency only. Interventions could be developed to explore the effectiveness of supportive practice environments and strategies to motivate pharmacists to adopt prescribing.

5.2 Introduction

Canadian pharmacy regulatory bodies have expanded pharmacists' scope of practice in different provinces in past decade to address timely access to health care services.(1-4) The extensive implementation of Canadian pharmacists' expanded scope of practice could save the Canadian healthcare system $25.7 billion over the next 20 years though savings could be as low as $194 million with low adoption.(5) As a part of the expanded scope of practice, pharmacists are authorized to prescribe prescription medications excluding narcotic and controlled drugs. However, the scope of prescribing practice varies by province.(1) Alberta was the first province to receive the prescribing authorization.(6)

Albertan pharmacists can independently prescribe in several ways: therapeutic substitution, dose alteration, and formulation or regimen alteration.(1) They are also allowed to renew prescription to ensure continuity. Albertan pharmacists with Additional Prescribing Authority (APA) can initiate independently any prescriptions. Thus, pharmacists in Alberta can practice different types of prescribing based on the patients' need and their own competencies. After any prescribing activities pharmacist are required to inform primary health care provider about their decision and

rationale for prescribing. Additionally, Albertan pharmacists are authorized to inject vaccines, and schedule one drugs as well as can order and interpret lab test for the patients.

Although Albertan pharmacists have had wide-ranging prescribing rights since 2007, only 2.6% of total prescribing in Alberta was performed by pharmacists in 2015 whereas they comprised 11.7% of the total prescribers.(7) It is complex to predict the optimum amount of prescribing nevertheless the above data suggests pharmacists in Alberta have opportunities to increase the frequency of prescribing. Furthermore, according to the latest data available, only about 24.6% of all pharmacists in Alberta have APA (8) which suggests the slower adoption of the maximum scope of prescribing activities. However, greater access to the healthcare services and maximum value from the expanded scope of practice could be achieved by ensuring adoption of higher frequency and a wider range of prescribing practices. Therefore, it is imperative to understand the factors impacting the frequency and types of prescribing adoption.

Adoption of the new behavior is complex; Diffusion of Innovation (DoI) theory by Rogers explains how an innovation becomes a part of practice over time.(9,10) This theory elucidates diffusion process of an innovation, and the rate and extent of its adoption by the end user. A greater level of diffusion is related to higher level of adoption of the innovation. In a large-scale systematic review, Greenhalgh described a model of DoI in health service organization.(11) In pharmacy practice, DoI theory has been used to assess the acceptability of an innovative contraception practice among rural pharmacists.(12-14) Researchers reported a high degree of acceptability and feasibility for independent prescribing of hormonal contraceptives in British Columbia, Canada.(13) This theory was also applied to understand the diverse factors that influenced pharmacists' adoption of newly reclassified medicine and over the counter prescribing in Scotland.(14)

Our research team in Alberta applied the "Diffusion of Innovation" (DoI) theory to understand the complex nature of pharmacist prescribing adoption.(15) We interviewed pharmacists in Alberta to explore facilitators and barriers to the uptake and implementation of prescribing in practice and found that prescribing behaviors are mostly influenced by practice setting, prior practice, self-efficacy beliefs, and relationship with physicians.(15) While the qualitative work so far has been helpful, further quantitative research was warranted to test the elements found in previous qualitative research (15) and generalize the findings among the larger sample of practicing pharmacists in Alberta.

Quantitative research has potential to help us understand pharmacists' adoption of prescribing according to the DoI framework and identify factors influencing both the frequency and the type of pharmacist prescribing in everyday practice. Researcher in the UK, and Australia also explored barriers and facilitators to implementing prescribing into practice which include training, confidence, multidisciplinary support, and use of guidelines. (16-23) Applicability to Alberta is not clear as the model and scope of prescribing differs among these countries. Pharmacists in Australia are eligible to prescribe certain non-prescription medications available from pharmacists and to continue supply by "emergency prescription" and "repeat prescription" system.(22) Pharmacists in the UK can practice supplementary prescribing in a collaborative agreement with a medical prescriber and independent prescribing authority is given to them after completion of a course under the supervision of a medical practitioner.(23) While in Alberta, additional training is not required to prescribe. Any licensed pharmacist is eligible to change or renew prescriptions independently using their own professional judgment. In order for pharmacists to initiate new prescription independently, pharmacists submit a comprehensive application package to the College of Pharmacists that includes evidence of the care they

provide. Albertan pharmacists have a unique prescribing practice which is independent as well as collaborative. Even though there is no agreement or formulary, pharmacist prescribers in Alberta are expected to communicate their prescribing decisions and rationale to other relevant healthcare professionals as well as develop collaborative goals of therapy. These unique differences in pharmacist prescribing practice may alter the adoption process.

5.3 Objectives

The objective of this study was to examine the factors that have impacted Albertan pharmacists' frequency and types of prescribing adoption using the Greenhalgh's model of DoI theory using a quantitative survey. We explored the relationship of the adoption of pharmacist prescribing with the anticipated factors, derived from DoI theory.

5.4 Conceptual framework

In a large-scale systematic review, Greenhalgh described a model of DoI in health service organization.(11) Greenhalgh's model illustrated eight features of diffusion of innovation. Due to the absence of the external or organizational lens in our survey data collection procedures, we excluded the four features of DoI model: outer context, system antecedents, implementation process, and linkages between design and implementation stages.(11) We applied the remaining four features of DoI theory in order to understand the pharmacist prescribing adoption- system readiness, communication and influence, the adopters, and the innovation.(11)

First, system readiness that included the impact of supportive practice norms and cultural issues on the adoption of prescribing. Different features of practice settings such as working environment, practice location, employers' and patients' expectation, and practice culture of the system were supposed to influence adoption of pharmacist prescribing. Second, communication and influence included the amount of interaction of pharmacists with the physicians and other

healthcare providers. Since the physicians are considered as primary prescriber and health care providers, relationships and communication patterns of the pharmacist with them should shape the adoption of prescribing.

Third, pharmacists were considered as adopters and their characteristics should influence the adoption of prescribing. Their prescribing adoption level may be predicted by their patient care intensity, self-efficacy belief, prescribing belief, education, and experience. We used the Self-efficacy theory to evaluate the confidence of pharmacists toward performing prescribing activities assuming that self-efficacy should influence their decision to learn and set a goal for the adoption of this innovation into practice.(24) Cognitive role theory was also used to understand pharmacists' perceptions and expectations of their own role as a prescriber.(25) Positive beliefs towards prescribing role may warrant greater adoption of prescribing. Finally, increased the perceived benefit or relative advantage of pharmacist prescribing may increase its frequency and types of adoption. We developed a conceptual model using the features of these theories to address the objective of the study. (Figure 5.1)

5.5 Methods

5.5.1 Research Design

In this secondary data analysis, we used multiple regression analysis to predict factors contributing to the frequency of pharmacist prescribing adoption and logistic regression analysis to explore factors predicting the type of prescribing adoption. This study was approved by the Health Ethics Research Board Panel B, University of Alberta.

5.5.2 Procedures and participants

This quantitative study is a part of a larger project of pharmacist prescribing in Alberta. A research group at the Faculty of Pharmacy and Pharmaceutical Sciences, University of Alberta designed a three-phase project to understand pharmacist prescribing adoption in Alberta. They developed a cross-sectional mixed mode survey to describe and explore uptake of pharmacist prescribing in Alberta.(26) Details of survey development are described in Guirguis LM et.al. (2017).(26) The final cross-sectional survey was administered among random sample of 700 practicing registered pharmacists in Alberta from April 19, 2013 to June 10, 2013.(26)

5.5.3 Dependent variables

We measured prescribing frequency and type of prescribing to assess the pharmacists' adoption of prescribing. First, to measure the frequency of prescribing adoption, we asked how often they prescribed in last month. It has five items. We scored "multiple times a day" as "5", "once a day" as "4", "several times a week" as "3", "several times a month" as "2" and "once a month or less" as "1". We calculated the mean of the scores. We assessed normality of the "frequency of prescribing" by using QQ plot test and found this variable is normally distributed.

Second, to identify types of prescribers, we relied on a prior cluster analysis which characterized the participant into three groups according to their self-reported prescribing practice.(27) The largest group (74% of total participants) was the "Renewal focused prescriber" who primarily practiced renewal prescribing.(27) Another group was the "Modifier" (17% of total participants), who were mostly involved in altering dose prescribing, altering formulation prescribing, and substituting prescribing drug within the similar therapeutic class.(27) The smallest group (9% of the total participant) was involved in almost all types of prescribing activities in different extent and named as "Wide ranged prescriber".(27) As the second two clusters were substantially

smaller than the first and both encompass a range of prescribing type activities, we combined "Modifier" and "Wide ranged prescriber" as "Multifaceted prescriber". We had two major types of prescribers - "Renewal focused" and "Multifaceted prescriber". Multifaceted prescribing was considers as a higher level of adoption as more prescribing practices were employed while practicing renewal focused prescribing was a lower level of prescribing as only one form of prescribing was adopted.

5.5.4 Predicting variables

We measured the following features with the respective independent variables - system readiness (i.e. practice setting, support from practice setting, and support form healthcare providers), communication and influence (i.e. communication with physician and communication with other healthcare professionals) pharmacists as prescribers (i.e. care intensity, self-efficacy beliefs, prescribing beliefs, experience, allocated time for dispensing activity, allocated time for patient care), and prescribing as innovation (i.e. impact on professionalism, impact on patient care).(28) Association of the variables with the conceptual model is summarized in Figure 5.1.

We examined correlation matrix among the predictor variables before running the regression analysis. (Table 5.1) We removed the variables which showed the correlation of 0.4 or more with one or more than one other variables. Thus we removed "Support from healthcare professionals", "Communication with physicians", "Communication with other health care providers", "Allocated time for dispensing, "Allocated time for patient care", and "Impact on professionalism" as they were all correlated with practice setting.

Participants were asked about their practice setting using 12 items. Due to lack of scope to prescribe we removed teaching or academic work location. Large grocery or box store, chain

community, franchise community, and hospital outpatient pharmacies and independent community pharmacies were grouped as “community setting” and scored as “1”. Primary care network, home care facility, physician’s office, ambulatory care setting, long-term care, and hospital inpatient were collapsed into “Collaborative setting” and scored as “0”. Furthermore, we measured the support from practice environment using responses to a five-point Likert scale question containing seven items about different factors, such as pharmacy staffing, access to patient information, patient expectation, as support or barrier (Chronbach’s alpha=0.78).(28)

We measured “care intensity” using responses to questions about daily activities regarding patient care at different practice settings. For example, community pharmacists were asked about the proportion of new or refill patient they talked in last month about health or medication issues. Hospital pharmacists were asked about the proportion of their patient whom they educated about drug therapy in last month. These questions were designed based on seven points Likert scale from “None” to “All”(1= none, 2=few, 3=less than half, 4=half, 5=more than half, 6=most, 7=all). We transformed the items into the standardized scores as we used scores from different questions specified for different types of practice setting. We also measured participants’ self-efficacy by assessing how sure pharmacists are about their prescribing decisions and activities using question with six items designed as five points Likert scale. The Chronbach’s alpha value of 0.89 suggested high reliability of the self-efficacy scale.(28) We measured the prescribing beliefs of participants using a question with five items designed as seven-point Likert scale about their activities and liabilities as prescriber (Chronbach’s alpha=0.58).(28) Additionally, we measured practice experiences in years.

To measure the impact on patient care, three items designed as five-point Likert scale asked about the impact of prescribing on their time spent with the patient, time spent assessing patient and quality of patient care (Chronbach's alpha=0.78).(28)

The variables that we measured using Likert scale were considered as continuous variables.(29) We had multiple items under each question using a Likert scale and we used the mean of the items as the response to that question. Therefore, we treated the variables as continuous instead of categorical.

5.5.5 Analysis

In order to predict the frequency of pharmacist prescribing adoption, we ran hierarchical multiple regressions based on the conceptual framework, that we discussed earlier. We used sequential logistic regression analysis to predict the type of pharmacist prescriber (i.e. renewal focused prescriber or multifaceted prescriber) from the same set of predictor variables that we used in multiple regression analysis. We tested the assumptions of cases to IVs ratio, an absence of outliers, multicollinearity, normality, linearity, homoscedasticity before running regression analysis. Research questions were tested in three blocks. The model is mentioned in Table 5.2. Literature suggested a strong relationship of "adoption of prescribing" with "practice setting"(30), and "extent of support".(15) Therefore, we entered these variables in the first block. We entered "care intensity", "self-efficacy beliefs", "negative prescribing beliefs", and "length of experience" variables in the second block of regression analysis. In the third block, we entered "impact on patient care" variable. $P<0.05$ was considered significant.

5.6 Results

The survey response rate was 54% (i.e. n=378) and of those, 350 pharmacists were providing direct patient care. Three hundred and twenty-seven participants (93%) were involved in prescribing activities. The female participants made up 69.5% of the sample. The sample was 81.3% in the community settings, and 57.1% practicing in the large urban area. The average age of the participant was 41 years. APA pharmacists were 6.7% of the total sample. (Table 5.3)

5.6.1 Frequency of pharmacist prescribing adoption

Prior running hierarchical multiple regression analysis, we tested multicollinearity and found variance inflation factors (VIF) value <1.34 presenting a very low level of multicollinearity among independent variable. Assumptions of normality, independence of error, an absence of outliers, and a ratio of cases to independent variables were met. The final stage of the regression model with practice setting, support from practice setting, care intensity, self-efficacy beliefs, negative prescribing beliefs, length of experience and impact on patient care variables predicted the frequency of pharmacist prescribing adoption ($R = 0.38$, $R^2 = 0.14$). Beta coefficients for the four predictors were found significant ($p<.05$)- Practice setting, standardized (std) $\beta = 0.12$; support form practice environment, std $\beta = 0.11$; Year of experience, std $\beta = 0.14$; and self-efficacy beliefs, std $\beta = 0.31$, (Table 5.4). Pharmacists in the community setting adopted more frequent prescribing than in the collaborative setting. Additionally, pharmacists, who had more confidence in themselves, experience, and support prescribed more frequently.

5.6.2 Types of pharmacist prescribing adoption

We ran the sequential logistic regression analysis to predict types of prescribing (i.e. renewal focused and multifaceted prescriber) adoption by pharmacists. The logistic regression model was statistically significant, $X^2(7)=100.71$, $p<0.01$. The model explained 41.9% (Nagelkerke R^2) of

the variance and correctly classified 84.6% of cases. Out of seven predictors only two (i.e. practice settings and self-efficacy beliefs, $p<0.05$) significantly predicted the type of prescribing adoption, (Table 5.5). Community pharmacists were 26.03 times more likely to exhibit renewal focused prescribing than the pharmacists in a collaborative setting. A higher level of self-efficacy beliefs was associated with an increased chances of exhibiting multifaceted prescribing (Exp B=0.65, $p<0.05$).

5.7 Discussion

Diffusion of innovation (9-11), self-efficacy (24), and cognitive role belief (25) theories guided us to identify the factors affecting the pharmacist prescribing adoption. We analyzed the relationship of these factors with the frequency and type of pharmacist prescribing adoption. Self-efficacy was the main predictor of prescribing frequency whereas practice setting was the key predictor of pharmacist prescribing type in Alberta. The frequency of prescribing was also positively predicted by community practice setting, practice support, and year of experience. Higher frequency prescribing adoption does not signify that pharmacists are employing the full scope of prescribing types. The types of prescribing practice (i.e., renewal and multifaceted) may provide better insight into the level of adoption. Specific examples of the complex nature of adoption for each predictor and possible explanations will be discussed below.

The influence of practice setting (i.e. community and collaborative) on adoption differed according to the frequency and type of prescribing. Pharmacists in the community setting reported more frequent prescribing (i.e., greater adoption) than those in collaborative practice. Yet, these same community pharmacists reported lower adoption as they were mainly involved in one type of prescribing (i.e., renewal focused) compared to those in the collaborative setting who were more likely to practice multifaceted prescribing (i.e. greater adoption). A possible

explanation of this result might be that community pharmacists have increased accessibility to the patients and patients can easily request refills from the community pharmacist. Prescribing for continuity legitimized the prior practice of pharmacists providing patients with short supplies of medications until they could see their physicians.(15) Furthermore, as we found practice setting is highly correlated with the relationship with physicians and allocated time for patient care, therefore, we can imply that community pharmacists might be hesitant to adapt new prescription due to inadequate personal relationships with the physicians and limited access to patient information. On the other hand, in a collaborative practice setting, pharmacists are working with physician prescribers which might reduce the necessity for pharmacist prescribing. This finding is contrary to previous studies which have suggested that in the UK hospital pharmacists adopted more prescribing compared to community pharmacists.(17) This inconsistency may be due to the lack of information in our analysis about the total patient that pharmacists provided care in the past month. It is expected that frequency of prescribing should vary according to that number. However, pharmacists in collaborative settings have dedicated time and space for clinical assessment of the patients which might facilitate the adoption of multifaceted prescribing adoption (i.e. higher adoption). This finding is in accord with other research which found that hospital pharmacists in Alberta practiced adaptation of prescription (i.e. formulation changing, dose titrating, and substituting) for almost half of the patients they provided care.(31,32)

Turning now to the self-efficacy, the major predictor of prescribing frequency, we see that it was positively associated with adoption of a higher frequency of prescribing and also influenced multifaceted prescribing adoption. Self-efficacy theory explains that adopters having a greater level of self-efficacy have greater ability to accept challenges.(10,24,33). Multifaceted

prescribing may involve additional perceived risk and complex pharmacotherapy issues. Therefore, it is reasonable that multifaceted prescribers had a higher level of self-efficacy in prescribing activities compared to renewal focused prescriber. Although several previous studies reported about pharmacists' personality trait and its relation with their prescribing activities (34, 35), we measured self-efficacy for the first time to predict pharmacist prescribing adoption and found a significant relationship. We used self-efficacy because in reviewing the literature, we found that self-efficacy is a good predictor of performance (24) and more strongly correlated with the perceived achievement of medical students compared to personality traits (36). Moreover, it can describe personality traits specially conscientiousness and its relation to performance.(37) However, our finding seems consistent with another study evaluating the impact of self-efficacy on pharmacist counseling service and reported pharmacists with higher self-efficacy showed higher inclination in counsel diabetic patients.(38)

One anticipated finding of our study was that pharmacists with higher support experiences adopted a higher frequency of prescribing. In our study, the supportive factors from practice environment included access to patient information, patient expectations, employer's expectations, staffing at practice location and practice environment. Similar supportive factors were documented for prescribing implementation in the United Kingdom (UK).(16,17,20,39) Practice experience was also positively associated with the frequency of prescribing. The pharmacists with more experiences were prescribing more frequently. A possible explanation for this result might be that pharmacists with more experience are expected to have more confidence in providing clinical care and more likely to adopt prescribing. This result supports previous research which reported extended work experience increased pharmacy students' self-efficacy towards patient care.(40) However, some other literature suggest contradictory results that

pharmacists with less practice experience were found to provide more patient information to patients and smoking cessation services than more experienced pharmacists.(41,42) Adapting with the recent cultural shift in pharmacy practice could be more challenging for some pharmacists who were used to in traditional practice for a longer period. Additionally, redesigned curriculum focusing on pharmacist prescribing should help facilitating the prescribing adoption among new pharmacists.(43,44)

One unanticipated finding of our study was an insignificant relation of perceived benefit with pharmacist prescribing adoption. On the contrary, a study exploring Australian pharmacists' views on pharmacist prescribing reported increased patients' access to care as one of the key reasons for pharmacists playing prescribing role.(21) Literature also suggests that patient benefit was the major perceived benefit of pharmacists for implementing supplementary prescribing into practice in the UK.(17) It is to be noted that, pharmacists in Australia and supplementary pharmacist prescribers in the UK are not able to prescribe independently. In contrast, most of the pharmacists in Alberta take the decision of prescribing independently which involves increased liabilities. Due to the autonomous nature of the prescribing practice in Alberta, pharmacists might be more concern about their own attributes (i.e. self-efficacy and experience) and practice environment (i.e. practice setting and support) compared to the patient benefit.

Our study conceived the new idea that performing more frequent prescribing does not necessarily represents greater adoption. Type of prescribing adoption is also important criteria for a profound understanding of prescribing adoption. Our predictors explained only 14% of the variance of pharmacists' prescribing frequency. We used only four features of DoI theory due to the data collection lens of the study. The addition of other features of DoI theory would better-explaine the frequency of adoption.(11) However, our results gave a more comprehensive picture

of adoption as we explored predictors of both adoption frequency and types. Our findings may provide insight to other jurisdictions.

5.7.1 Limitations

Our data were collected in 2013. Change in nature of pharmacist prescribing is expected in last four years. We also could not measure non-adoption and its predictors as almost all of the participants (i.e. 93%) were involved in some form of prescribing. The rest of the 7% pharmacists did not prescribe but they were involved in making prescribing decisions with the other team members or they sent a fax to the physicians with the suggestion of prescribing.(26) However, the inclusion of information about the total patient to whom pharmacists provided care would allow us to make a better comparison of pharmacist prescribing frequency in different practice settings. We used observational and cross-sectional design; therefore, we cannot draw a causal conclusion regarding the relationships but we can assume associations. Moreover, regression analysis did not allow us to explore directionality of the relationship between the dependent and independent variables. Future use of Structural Equation Modeling may provide us information about multiple and interrelated dependencies among the variables. Our regression model explained 14% of the variability of the frequency of pharmacist prescribing adoption. The inclusion of other variables such as implementation process, payment model, manager approaches, patients' experiences and expectations may provide a better explanation of the adoption process.

5.7.2 Implications

Implications of the findings of our study for practice could be developing interventions focusing on system readiness and pharmacists' attributes to facilitate the adoption of prescribing. Stakeholders can focus on developing more supportive environment through adequate staffing,

giving necessary access to patient information, and fostering physician-pharmacist collaboration. Public awareness program about pharmacist prescribing can be developed to evolve their expectations from the pharmacist and make them willing to accept prescribing care from pharmacists. Along with these interventions, a workshop focusing on prescribing knowledge and skill can be developed for improving pharmacists' self-efficacy in adopting different types of prescribing.

Our findings could also have important implications for research. Research evaluating pharmacist prescribing adoption should consider that the measure of adoption as frequency and type of prescribing led to differing results. Pharmacist prescribing adoption and factors affecting the adoption could be compared among different jurisdiction to understand the best practice. Furthermore, research should also evaluate the impact of organizational factors, stakeholders' (i.e. patient, physician, other healthcare providers, and policy-makers) experiences, payment models, and implementation techniques on pharmacist prescribing adoption.

5.8 Conclusion

Our study recommends an overall readiness of practice environment to facilitate prescribing and pharmacists' own characteristics significantly impacted pharmacists' adoption of prescribing. These factors affected the frequency and types of prescribing adoption distinctively. A foremost driver of pharmacist prescribing adoption was practice setting. Frequency and type of prescribing adoption varied according to practice settings. Pharmacists' higher level of self-efficacy beliefs played a key role in higher frequency and multifaceted prescribing adoption. More supportive practice environment, as well as greater experience, might help pharmacists to perform multifaceted prescribing in the community setting. In due course, if community pharmacists expand their prescribing practice to include adapting and initiating as appropriate along with

pharmacists in collaborative setting increase their prescribing frequencies, it will probably ensure improved patient access to care and optimal use of pharmacists' clinical knowledge and skills.

5.9 References

1. Pharmacists' Expanded Scope of Practice in Canada, Canadian Pharmacists Association. [Updated 2016 Dec; cited 2017 Feb 23]. Available from: http://www.pharmacists.ca/index.cfm/pharmacy-in-canada/scope-of-practice-canada/
2. Wait Times Database, 2013, CIHI; OECD Health Data 2015
3. Altschuler J, Margolius D, Bodenheimer T, Grumbach K. Estimating a Reasonable Patient Panel Size for Primary Care Physicians With Team Based Task Delegation. *Ann Fam Med*. 2012;10:396-400
4. Law MR, Ma T, Fisher J, Sketris IS. Independent pharmacist prescribing in Canada. *Can Pharm J (Ott).* 2012;145(1):17-23.
5. Gagnon-Arpin I, Dobrescu A, Sutherland G, Stonebridge C, Dinh T. The Value of Expanded Pharmacy Services in Canada. Ottawa: The Conference Board of Canada, 2017
6. Yuksel N, Eberhart G, Bungard TJ: Prescribing by pharmacists in Alberta. *Am J Health Syst Pharm* 2008, 65(22):2126–2132.
7. Alberta Pharmacists' Prescribing Practices (PIN Data) 2015
8. Alberta College of Pharmacists Annual Report 2015-2016. [Updated 2016 Feb; cited 2017 Feb 23]. Available from: https://pharmacists.ab.ca/articles/2015-2016-annual-report-now-available
9. Rogers EM. Diffusion of Innovations: Fourth ed. New York: The Free Press; 1995.
10. Rogers EM. Diffusion of Innovations: 4th ed. New York: The Free Press; 2003.

11. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Q*. 2004;82(4):581-629.

12. Wong M, Soon JA, Zed PJ, Norman WV. Development of a Survey to Assess the Acceptability of an Innovative Contraception Practice among Rural Pharmacists. *Pharmacy.* 2014, *2*: 124-136

13. Norman WV, Soon JA, Panagiotoglou D, Albert A, Zed PJ. The acceptability of contraception task-sharing among pharmacists in Canada — the ACT-Pharm study. *Contraception.* 2015. 92:55–61.

14. Paudyal V, Hansford D, Cunningham S, Stewart D. Over-the-counter prescribing and pharmacists' adoption of new medicines: Diffusion of innovations. *Res Social Adm Pharm* 2013; 9: 251–262.

15. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N**.** Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. *Implement Sci.* 2013; 8(1):109

16. Warchal S, Brown D, Tomlin M, Portlock J. Attitudes of successful candidates of supplementary prescribing courses to their training and their extended roles. *Pharm. J.* 2006; 276.

17. George J, McCaig DJ, Bond CM, Cunningham IT, Diack HL, Watson AM, et al. Supplementary prescribing: Early experiences of pharmacists in Great Britain. *Ann Pharmacother*. 2006;40(10):1843-50.

18. Bourne RS, Baqir W, Onatade R. Pharmacist independent prescribing in secondary care: opportunities and challenges. *Int J Clin Pharm.* 2016;38:1–6

19. Fisher J, Kinnear M, Reid F, Souter C, Stewart D. What supports hospital pharmacist prescribing in Scotland? – A mixed methods, exploratory sequential study. *Res Social Adm Pharm.* 2017; 10.1016/j.sapharm.2017.06.007
20. Auta A, Strickland-Hodge B, Maz J, Alldred DP. Pharmacist prescribing in the United Kingdom and the implication for the Nigerian context. *West Afr J Pharm*. 2015;26(1):54-61.
21. Hoti K, Sunderland B, Hughes J, Parsons R. An evaluation of Australian pharmacist's attitudes on expanding their prescribing role. Pharm World Sci. 2010; 32:610–621
22. Hoti K, Hughes J, Sunderland B. An expanded prescribing role for pharmacists – an Australian perspective. *AMJ.* 2011; 4(4):236-242
23. Cope LC, Abuzour AS, Tully MP. Nonmedical prescribing: where are we now? *Ther Adv Drug Saf.* 2016;7(4):165–172
24. Bandura A. Self-efficacy. In V. S. Ramachaudran (Ed.), Encyclopedia of human behavior (Vol. 4, pp. 71-81). New York: Academic Press. 1994.
25. Biddle B. Recent developments in role theory. *Annu Revi Sociol,* 1986, 12, 67-92.
26. Guirguis LM, Hughes CA, Makowsky M, Sadowski C, Schindel T, Yuksel N. Survey of Pharmacist Prescribing Practices in Alberta. *Am J Health Syst Pharm*. 2017; 74:(2):62-69
27. Faruquee CF, Cor K, Hughes CA, Makowsky M, Sadowski C, Schindel T, et al. Characterizing pharmacist prescribers in Alberta using cluster analysis (Under review, Chapter four)
28. Guirguis LM, Hughes CA, Makowsky M, Sadowski C, Schindel T, Yuksel N. Development of a Survey to Explore Pharmacists Prescribing Practices (Under review, Chapter three)

29. Sullivan GM, Artino Jr AR. Analyzing and interpreting data from Likert-type scales. Journal of graduate medical education. 2013;5(4):541-2.
30. Guirguis LM, Makowsky MJ, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N. How have pharmacists in different practice settings integrated prescribing privileges into practice in Alberta? A qualitative exploration. J Clin Pharm Ther. 2014;39(4):390-8.
31. Heck T, Gunther M, Bresee L, Mysak T, Mcmillan C, Koshman S. Independent prescribing by hospital pharmacists: Patterns and practices in a Canadian province. *Am J Health Syst Pharm.* 2015; 72 (24): 2166-2175
32. Hwang S, Koleba T, Mabasa VH. Assessing the Impact of an Expanded Scope of Practice for Pharmacists at a Community Hospital. *Can J Hosp Pharm*. 2013; 66(5): 304–309.
33. Lunenbarg FC. Self-Efficacy in the Workplace: Implications for Motivation and Performance. *IJMBA*. 2011; 14 (1) [Updated 2011 Dec; cited 2017 May 15]. Available from: http://www.nationalforum.com/Electronic%20Journal%20Volumes/Lunenburg,%20Fred%20C.%20Self-Efficacy%20in%20the%20Workplace%20IJMBA%20V14%20N1%202011.pdf
34. Hall J, Rosenthal M, Family H, Sutton J, Hall K, Tsuyuki RT. Personality traits of hospital pharmacists: toward a better understanding of factors influencing pharmacy practice change. Can J Hosp Pharm. 2013;66(5):289-295.
35. Rosenthal MM, Houle SK, Eberhart G, Tsuyuki RT. Prescribing by pharmacists in Alberta and its relation to culture and personality traits. *Res Social Adm Pharm.* 2015;11(3):401-11

36. Guntern S, Korpershoek H & Werf GV. Benefits of personality characteristics and self-efficacy in the perceived academic achievement of medical students. *J. Educ. Psychol.* 2017; 37:6, 733-744

37. Chen G, Casper WJ, Cortina JM. The Roles of Self-Efficacy and Task Complexity in the Relationships Among Cognitive Ability, Conscientiousness, and Work-Related Performance: A Meta-Analytic Examination. *Hum Perform.* 2001; 14(3): 209-230

38. Guirguis LM, Chewning BA, Kieser MA. Predictors of Pharmacy Students' Intentions to Monitor Diabetes. *J Pharm Pharmaceut Sci.* 2009; 12(1):33 – 45.

39. Tonna AP, Stewart D, West B, McCaig D. Pharmacist prescribing in the UK - a literature review of current practice and research. *J Clin Pharm Ther.* 2007;32(6):545-556.

40. Yorra ML. Self-efficacy and self-esteem in third-year pharmacy students. *Am Journal Pharm Edu*. 2014;78(7):134.

41. Saba M, Diep J, Bittoun R, Saini B. Provision of smoking cessation services in Australian community pharmacies: a simulated patient study. *Int J Clin Pharm.* 2014, 36:604–614

42. Svarstad BL, Bultman DC, Mount JK. Patient Counseling Provided in Community Pharmacies: Effects of State Regulation, Pharmacist Age, and Busyness. *J Am Pharm Assoc.* 2004;44:22–29.

43. Frankel GEC, Austin Z. Responsibility and confidence: Identifying barriers to advanced pharmacy practice. *Can Pharm J (Ott).* 2013;146:155-161.

44. Austin Z, Ensom MHH. Education of Pharmacists in Canada. *Am J Pharm Educ*. 2008; 72(6): 128.

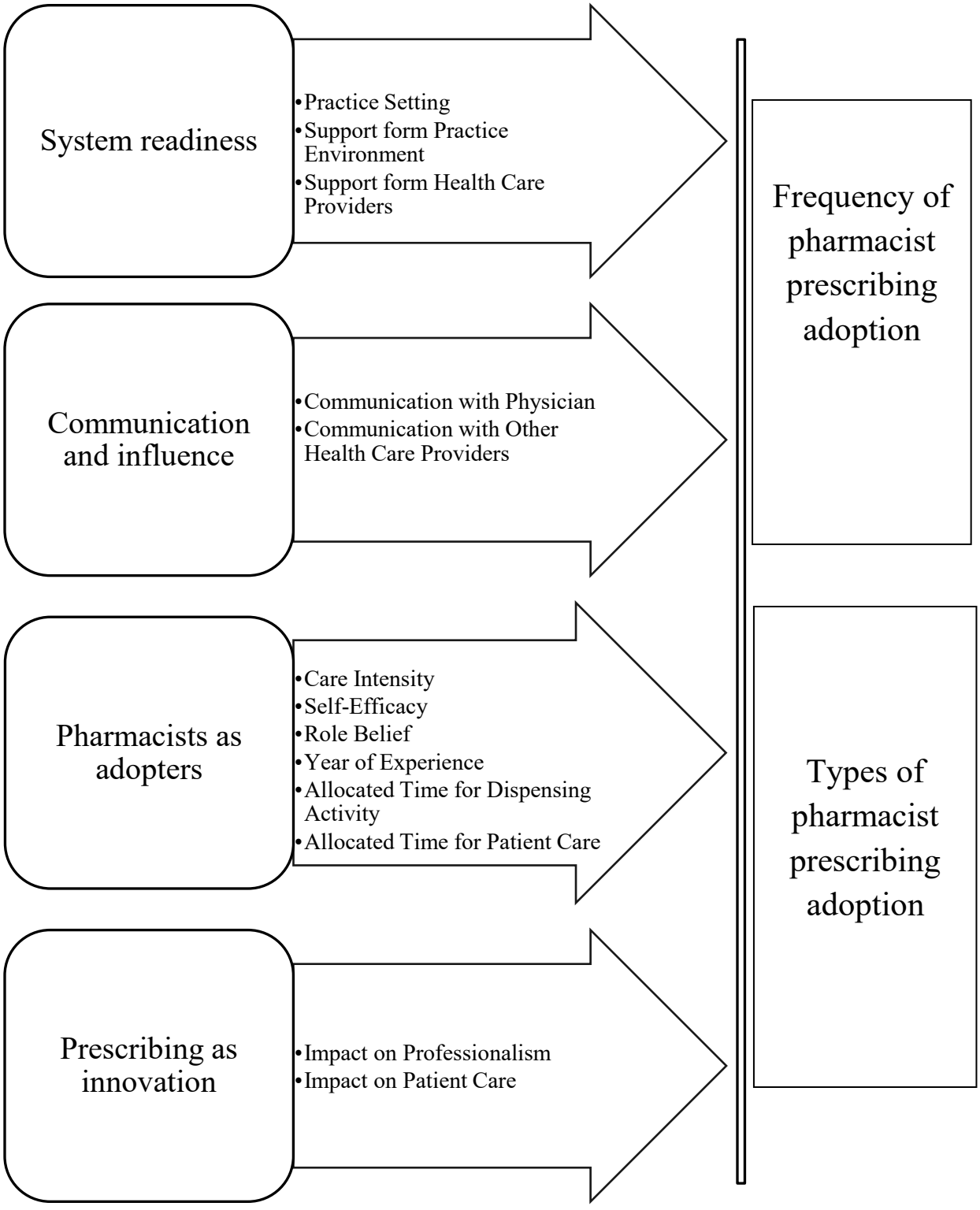

Figure 5.1 Conceptual framework for exploring factors affecting pharmacist prescribing adoption

Table 5.1 Correlation between Predicting Variables

		Practice setting	Support form practice environment	Support form healthe care provider	Communication with physicians	Communication with other health careproviders	Care intensity	General self-efficacy belief	Negative role belief	Length of Experience	Allocated time for dispense	Allocated time for patient care	Impact on professionalism	Impact on patient care
Systemreadiness	Practice setting	1												
	Support form practice environment	0.08	1											
	Support form healthe care provider	0.25	0.54	1										
Communication andinfluence	Communication with physicians	0.62	0.05	0.26	1									
	Communication with other health careproviders	0.62	0.02	0.26	0.72	1								
Pharmacistsasadopters	Care intensity	-0.03	0.21	0.13	0.06	0.10	1							
	General self-efficacy belief	-0.09	-0.33	-0.29	-0.19	-0.22	-0.21	1						
	Negative role belief	-0.14	0.02	-0.04	-0.07	-0.07	0.06	0.16	1					
	Length of Experience	0.03	-0.09	0.03	0.01	0.00	-0.14	0.30	0.02	1				
	Allocated time for dispense	-0.50	-0.25	-0.31	-0.48	-0.46	-0.19	0.35	0.09	0.07	1			
	Allocated time patient care	0.55	0.19	0.25	0.43	0.42	0.12	-0.21	0.01	-0.09	-0.83	1		
Prescribing as innovation	Impact on professionalism	0.17	0.36	0.41	0.17	0.18	0.10	-0.41	-0.13	-0.05	-0.26	0.20	1	
	Impact on patient care	-0.12	0.22	0.09	-0.07	-0.08	0.07	-0.22	0.03	-0.18	-0.05	0.01	0.41	1

Table 5.2 Blocks and Corresponding Independent Variables of Hierarchical Multiple Regression Model and Sequential Logistic Regression Model

Blocks	Features	IVs
Block 1	System Readiness	Practice setting, support form practice setting
Block 2	Pharmacists as Adopters	Care intensity, self-efficacy beliefs, prescribing beliefs, year of experience
Block 3	Prescribing as Innovation	Impact on patient care

Table 5.3 Demographics of participant pharmacists

Characteristics	No. of participants (%)
Total participants	378
Pharmacist involved in prescribing activity	327
Gender[a]	
Female	221 (69.5)
Male	97 (30.5)
Age (years)[b]	
≤30	73 (23.0)
31-60	226 (71.3)
61≥	18 (5.7)
Practice setting	
Community settings	266 (81.3)
Hospital/consultancy settings	61 (18.7)
Practice area[c]	
Large urban population centre (100,000 or greater)	186 (57.1)
Medium population centre (30,000 to 99,999)	52 (16.0)

Small population centre (1,000 to 29,999)	85 (26.1)
Rural (population less than 999)	3 (0.9)
Pharmacists with APA[d]	22 (6.7)
a: Responded by 318 participants; b: Responded by 317 participants; c: Responded by 326 participants; d: Additional Prescribing Authority	

Table 5.4 Hierarchical Multiple Regressions to Predict Frequency of Pharmacist Prescribing

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
Predictors	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
Practice Setting	0.36	0.16	0.12	2.27	0.02	0.05	0.67
Support from Practice Setting	0.15	0.08	0.11	2.05	0.04	0.01	0.29
Care Intensity	0.05	0.12	0.03	0.45	0.65	-0.18	0.28
Year of Experience	0.01	0.01	0.14	2.59	0.01	0.00	0.02
Prescribing Beliefs	-0.12	0.07	-0.08	-1.46	0.15	-0.25	0.04
Self-Efficacy	0.41	0.08	0.31	5.174	0.00	0.25	0.56
Impact on Patient Care	0.01	0.13	0.00	0.07	0.94	-0.24	0.26

*Practice setting: 1=Community Setting, 0=Collaborative Setting

Table 5.5 Sequential Logistic Regressions to Predict Types of Pharmacist Prescribing

Predictors	B	Standard Error	df	Sig.	Exp(B)	95.0% Confidence Interval for EXP (B)	
						Lower Bound	Upper Bound
Practice Setting (1)	3.26	0.41	1	0.00	26.03	11.72	57.83
Support from Practice Environment	0.03	0.12	1	0.86	1.04	0.70	1.53
Care Intensity	0.14	0.32	1	0.66	1.15	0.62	2.14
Self-Efficacy	-0.43	0.21	1	0.04	0.65	0.43	0.97
Prescribing Beliefs	0.12	0.19	1	0.52	1.13	0.78	1.65
Year of Experience	0.03	0.02	1	0.06	1.03	0.99	1.06
Impact on Patient Care	0.11	0.35	1	0.75	1.11	0.56	2.21

*Types of prescribing: 1=Renewal Focused Prescriber, 0= Multifaceted Prescriber

*Practice setting: 1=Community Setting, 0=Collaborative Setting

Chapter Six

Family physicians' perceptions about pharmacists prescribing in Alberta

Chowdhury F Faruquee, Amandeep S Khera, Lisa M Guirguis

6.1 Abstract

Background: Pharmacists are medication experts with prescribing authority who can help both physicians and patients to manage medications. However, little is known about the experience and relational dynamics of family physicians evolving around the pharmacists' new prescribing practice. Our objectives of this study was to explore the Albertan physicians' perceptions and experiences about pharmacist prescribing practice

Methods: We used purposeful and maximum variation sampling method and semi-structured face to face or telephone interviews to collect data. We interviewed Albertan family physicians, who had experience of pharmacist prescribing in their practice. We also interviewed pharmacists, who were working with those physicians as team pharmacists, for a deeper understanding of context. Interviews were audio recorded and transcribed verbatim for analysis using interpretive description method to identify themes, guided by "Relational Coordination" theory. NVivo software was used to manage the data.

Results: We interviewed 12 physicians. Participants' three key beliefs (i.e., renewal versus initiate new prescription, community versus team pharmacists, and "I am responsible") about pharmacist prescribing were identified which shaped their collaboration process with the pharmacist prescribers. Trust and communication were prominent themes to determine their collaboration levels. Participants were classified as "collaborative" and "consultative" according to their collaboration level with the pharmacist prescribers.

Conclusion: Participants had greater collaboration with the team pharmacist prescribers compared to community pharmacists due to a higher level of trust and ease of communication. Renewal prescribing by any pharmacists was well accepted by the participants but they showed

hesitancy in accepting initiating new prescription by the pharmacists due to lack of awareness of pharmacists prescribing expertise and suitable communication strategies. Our findings should provide insight into interprofessional collaboration and communication while pharmacists are prescribing.

6.2 Introduction

The past two decades have seen family physicians' workload and time pressure as one of the major barriers to provide optimal patient care.(1-4) Professional satisfaction and patients' contentment, as well as care quality, are proportionately linked to this hurdle.(5-8) Existing research has recognized that delegating preventive and chronic care services to other non-medical health care providers can be one of the keys to addressing this issue.(9) Pharmacists are educated as well as trained in the use of medications and are capable of responding to patients' health and drug-related needs. Being important members of the healthcare team and having appropriate training in providing direct patient care, pharmacists are health care providers who could potentially be assigned with some of the tasks handled by physicians, thus reducing the physicians' workload.

Internationally, pharmacists' scope of practice has been expanding in the last two decades to include additional multidisciplinary and collaborative health care services.(10-14) The United Kingdom (UK) was the pioneer in this area and implemented supplementary prescribing rights in 2003 and independent prescribing rights in 2006.(10) Pharmacists in the United States (US) and New Zealand are prescribing in collaborative health team environments.(12-14) Australia is assessing the factors related to the implementation process and expected impact of this new role for pharmacists. (15) In Canada, pharmacists are now involved in many advanced medication-

related health services, including prescribing drugs, administering injections and vaccines, ordering lab tests and interpreting lab values, and medication review.(16)

Pharmacists' scope of practice varies from province to province in Canada. Since 2007, among all the provinces and territories, Alberta pharmacists have had the broadest scope of practice.(16,17) Albertan pharmacists can renew prescriptions to continue therapy; alter doses, formulations or regimens; make therapeutic substitutions; and, in an emergency situation, prescribe any drug excluding narcotics and controlled substances. Pharmacists with additional prescribing authority (APA) can initiate new prescriptions at the initial access of care and manage drug therapy for their patients. In all types of prescribing, Albertan pharmacists are permitted to use their own professional judgment, assess the therapy and a patient's condition, and use their clinical expertise to make independent prescribing decisions in a patient's best interest. However, after prescribing, they must communicate their decisions and rationale with the physicians or main health care provider. The literature suggests that the level of the physician's acceptance and perception of the expanded role of pharmacists has a significant impact on a pharmacist's prescribing practice.(18)

There is a developing body of research in the UK (19, 20), the US (21) and New Zealand (22) exploring physicians' opinions about pharmacists prescribing. Physicians in both the UK and the US reported that allowing pharmacists to prescribe reduced their workload and allowed them to concentrate on more specialized tasks.(21,23) But physicians in the UK were more negative about independent pharmacists prescribing compared to supplementary prescribing.(20)

Although pharmacists have been prescribing for one decade in Canada, to date only a few studies that have explored physicians' perceptions about the practice. In British Columbia, one study found that family physicians had limited experience with adaptation services of pharmacists.(24)

In Alberta, one study exploring physicians' perceptions focused on pharmacists' prescribing abilities to manage high-risk cardiovascular patients.(25) Finally, a third study found that physicians and other stakeholders perceived that prescribing activities made pharmacists more responsible, collaborative, and patient-centered.(26) Despite exploratory research on physicians' perceptions, little is known about Albertan physicians' overall perceptions, experiences, and understanding of pharmacist prescribing practice. Because of a unique combination of independent and collaborative nature of pharmacist prescribing, the findings in Alberta could be different than those in other jurisdictions.

6.3 Objectives

The objective of our study was to 1) explore the family physicians' perceptions and relational dynamics evolving around pharmacists' prescribing practice, and 2) provide information to physicians on the enhanced prescribing capacity of Albertan pharmacists.

6.4 Conceptual framework

To understand the relational dynamics of family physicians and pharmacist prescribers, we used Relational Coordination (RC) theory. RC is defined by Gittell (2002) as ''a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration.''(27) The RC theory applies to the work process in which various providers work independently using their expertise to achieve mutual goals.(28) We selected this theory because various health care providers (e.g., physicians, pharmacists, nurses, physiotherapists) in the Canadian health care system practice independently to improve patient health care. We wanted to focus on the subtleties of the physician and pharmacist prescriber relationship as they both independently perform common tasks such as prescribing and monitoring therapy.

The theory highlights three dimensions of a relationship (i.e., shared goal, shared knowledge, and mutual respect) and four dimensions of communication (i.e., frequent, timely, accurate, and problem-solving).(29) These dimensions reciprocally strengthen each other.(29) Shared goal is explained as the work process where people have mutual goals to achieve in agreement.(29) Shared knowledge is the level of knowledge of each other's training, expertise, and role.(29) Mutual respect is the recognition of each profession's specific pride and status by other professions. Effective coordination cannot be achieved where there is lack of mutual respect and collegiality.(29) Effective coordination is achieved when people communicate frequently, timely, and accurately by engaging with a problem-solving objective. The asence of any of these four elements in communication may result in misunderstanding, lack of coordination as well as negative consequences in performance.(29) The RC theory has been applied in chronic care delivery in the Netherlands (30) and nine hospitals in the US(31). Both of these quantitative studies found that optimizing coordination improved patient-care outcomes.(30, 31)

6.5 Methods

6.5.1 Research design

We used the qualitative method and a social constructive world-view to understand how physicians construct and maintain perceptions about pharmacists prescribing in their health care practice.(32) We applied the Interpretive Description (ID) method to design the data collection and analysis. This approach recognized our clinical knowledge and the disciplinary biases relevant to the pharmacy practice and family physician practice and also helped us to conceptualize the meaning.(33, 34) The research was approved by the Health Research Ethics Board of the University of Alberta.

6.5.2 Data collection

We conducted semi-structured face-to face-or telephone interviews with practicing family physicians in Alberta between October 2014 and February 2016 using an open-ended interview guide (Appendix 3). Face-to-face interviews were conducted in the physicians' practice setting. We used a purposive sampling method to include physicians who had experience with pharmacist prescribing. We also used a maximum variation sampling method to document the diverse experiences of family physicians. We interviewed family physicians practicing in different geographical contexts, practice settings, professional contexts and years of practice experience. To gain a broader understanding of the physician context, we asked participating family physicians to suggest team-based pharmacists who were practicing in the same PCN to interview. These interviews were not intended to illustrate the pharmacists' experience but to further understanding the physicians' experiences. We selected these pharmacists according to the physicians' suggestion provided during their (i.e. physicians') interview. We interviewed these pharmacists using an open-ended interview guide.(Appendix 4) Participants were recruited primarily by a family physician researcher who is an assistant professor in the Department of Family Physicians at the University of Alberta. All of the interviews were transcribed by a professional transcriber. Identifying information was removed from the transcriptions.

At the beginning of the interview, participants provided written consent (Appendix 5). We recorded our expectations, experiences, and perceptions in field notes before and after each interview. At the end of each interview, we shared information about pharmacist prescribing using the information sheet published by the Alberta College of Pharmacy.(35) This information sheet defined the different types of prescribing practices. Additionally, we answered physicians' questions about pharmacist prescribing.

6.5.3 Data analysis

ID is an inductive and iterative method that comprises four sequential cognitive processes of the data analysis.(36) The first process was comprehending the data, which started with the data collection and continued throughout the data analysis process. We started coding the transcribed interviews as soon we began collecting the data, and as part of the process, we developed reflective memos. Two researchers on our team used the open coding method to analyze the data and conducted discussions to resolve any inconsistency in coding. We created memos throughout the research process which created the journal of our reflections and the process of refining our understanding of the data. The information we gathered in the early interviews gave us useful insights to incorporate into the ongoing data collections. The second cognitive process was synthesizing, through which we tried to find the common patterns within the data. At this stage, we used constant comparative analysis and identified the similarities and dissimilarities between the interviews.(37) The third cognitive process is theorizing, through which we generated an explanation of the data and scanned the data from different angles. The constant comparative analysis facilitated us in relating our findings to the RC theory and shaping the results.(29, 36) We compared our findings with the features (i.e. shared knowledge, shared goal, mutual respect, and communication) of the RC theory and gave an explanation of our results in the light of the theory. The final stage of the cognitive process was recontextualizing our results to make them applicable in practical settings. In this phase, we recontextualized our findings into family physician and pharmacy practice. We used NVivo software to search and sort the vast amount of information and maintain consistency in redefining categories and themes. Adequate data collection occurred and interviews were stopped when additional interviews did not significantly contribute to the existing findings of the study.

6.6 Results

We interviewed 12 family physicians and two team pharmacists. Two participant physicians were from rural and ten of them were from urban areas. One of the urban physician participants had a practice in the inner city area. Participants' years of experiences varied from one year to 35 years. Two of the physician participants had specialty practice. (Table 6.1) The sample was divided evenly: 50% females, 50% males. The interviews ranged from 20 to 45 minutes (mean 32.5 minutes).

6.6.1 Awareness and experience with pharmacist prescribing

Participants were aware that pharmacists have the pharmacological knowledge and are able to provide expert opinions about possible drug interactions and the appropriateness of a prescription. Seven out of 12 participants had misperceptions about pharmacist prescribing. All the participants had experience with pharmacist prescribing to extend prescriptions for their patients. Some participants had experienced adaptation of prescription such as substitution drug or alteration dose for their patients. Only two participants were aware that a pharmacist can initiate a new prescription and the pharmacists in their practices had initiated very few.

6.6.2 Key beliefs about pharmacist prescribing

6.6.2.1 Renewal versus initiate new prescription

All participants believed that renewal prescribing reduced their workload and improved patient access to care. Four participants reported that pharmacists' renewal prescribing might interfere with their care plan because they provide shorter intervals refill for patients whose require additional follow-up. Participants were overall satisfied with the quantities that pharmacist prescribed for prescriptions renewals.

I haven't had a lot of pharmacists who have prescribed long amounts of medications that would require some sort of intervention before I would extend the prescription, so my experience has been fine so far. (Phy09)

On the other hand, they expressed anxiety about pharmacists initiating a new prescription or changing a prescription without prior discussion with the main prescriber. For example, one physician mentioned:

Refills are okay and if they do substitutions that's okay, as long as they're equivalent and as long as I've been told about it but I'm not really sure I'm comfortable with them prescribing. (Phy 05)

None of the participants accepted pharmacists' ability to initiate new prescriptions. They believed that pharmacists were not able to diagnose disease and access sufficient information about patients' condition and history. However, pharmacist prescribing according to guidelines or protocol, and straightforward substitutions were well trusted and accepted (e.g., warfarin dose adjustment, a specific condition, or a substitution within a similar therapeutic class or dose adjustment).

So they are running all the anti-coagulation services for me anyway, so I'm not doing this, so I'm comfortable with that. They all have certification in that kind of coagulation. They don't even call me. (Phy 04)

6.6.2.2 Community versus team pharmacist

Participants had distinct opinions about the differences between community and the team pharmacists prescribing. Team pharmacists worked together with physician to provide care to common patients. Participants believed that team pharmacists had more access to patient

information, through electronic medical records (EMR), than community pharmacists and this accessibility should facilitate pharmacist prescribing. Besides, community pharmacists faced time constraints and lacked the facilities to thoroughly assess a patient's condition which might lead to unsafe prescribing. As one participant said,

> *I don't think that they(community pharmacists) have the capacity in a pharmacy to do all the necessary background history-taking, past medical history-taking, physical exams, to necessarily prescribe a de novo drug, something new. (Phy 02)*

Participants also reported that team pharmacists were easily reachable either face-to-face or over the phone also participants could observe their prescribing expertise. On the contrary, community pharmacists were difficult to reach and physicians did not have sufficient contact to evaluate the pharmacist's proficiency in prescribing. As a whole, participants showed demarcation (38) between the community and team pharmacists as a prescriber due to their practice approach and physical isolation.

6.6.2.3 "I am responsible"

Participants believed that they were the ultimate responsible care provider as well as the main prescriber for their patients. Other health care providers helped them to ensure optimum care. They preferred other care providers including specialists to make recommendations leaving the primary physician to make decisions and take the responsibility for patient care.

> *So I think the only difference between technically them [pharmacists] prescribing and then giving suggestions is just that I have to okay it because I'm responsible at the end of the day, right? (Phy 07)*

Participants also strongly associated with diagnosis (i.e., a physician only role) and initiating a new prescription. As one participant commented:

> *So the physicians, I think, well the main prescribers, right? Because we made the diagnosis, right? (Phy 04)*

Another common view amongst most of the participant physicians was that the pharmacist should ask for a physician's approval before changing a prescribed medication or initiating a new medication. Failing to consult with the main prescriber might increase poly-pharmacy, patient risks, liabilities, and misunderstandings. Participants showed a clear indication of communication before any change or before initiating new prescriptions.

> *If they [pharmacists] are going to make clinical decisions about a patient, and they [pharmacists] don't call me [to get my consent], that's inappropriate. (Phy 06)*

6.6.3 Collaborative process

The participant and pharmacist prescriber collaboration was shaped by the participants' key beliefs. Two major themes emerged from the analysis of participants' collaboration process with pharmacist prescribers: trust and communication.

6.6.3.1 Trust

Participants' trust on pharmacist prescribing was a prominent indicator of "collaborative relationship". Participants' trust on pharmacist prescribing depended on the "shared knowledge", "shared goal", and "mutual respect" with the pharmacist prescribers. The level of trust of the pharmacist prescribing also depended on the type of pharmacist (i.e., community and team pharmacists).

Two participants (i.e., Phy 08, Phy 12), who worked in collaboration with their team pharmacists, appreciated pharmacists' clinical skills and expertise in medications and shared prescribing responsibilities. These participants demonstrated "mutual respect" toward pharmacist prescribers. Participant (i.e., Phy 12) indicated that his trusted team pharmacist did not need to seek approval prior prescribing whereas community pharmacists should.

> *This is not the clinical pharmacist situation where the physician has said, "I'm giving you the patient, you can manage it," but the community one is more…the physician has already prescribed a number of meds and now the community one wants to change them. If they just change whatever they want, it's harder for a physician to manage a patient. (Phy 12)*

Physician participant 08 extended this trust to community pharmacists.

> *Ideally, I should write a prescription to the pharmacy saying, "Please manage hypertension," and then the pharmacist will just take it from there. I mean that's the kind of thing that I think should happen. I'm best at sort of diagnosing and developing general treatment plans. My expertise is not in medications and that's where a pharmacist should be doing things. (Phy 08)*

6.6.3.1.1 Shared knowledge and goals influence trust

The trust participants exhibited in the pharmacists' renewal prescribing ability was supported by frequent experiences as well as positive patient outcomes. Proven expertise ensured participants' "shared knowledge" about pharmacists' renewal prescribing skill. As one participant said,

> *Certainly the impact on my practice of extending prescriptions that have been longstanding, right? So as long as it's not a brand new prescription, I think it's fantastic. (Phy 03)*

Participants showed lack of trust in pharmacists' ability to initiate a new prescription or changing a new prescription written by them. They had very few experience with pharmacists initiating new prescriptions or changing medication by pharmacists and thus participants' had little "shared knowledge" about pharmacists' expertise in initiating new prescription or changing medications. Participants were also lack of "shared goal" with the pharmacist prescribers when pharmacists initiated a new prescription or changed medications for their patients without their (i.e., participants') prior consent.

6.6.3.1.2 Proximity allows for mutual respect

Proximity allowed physicians to develop trust and mutual respect with pharmacists; however, proximity alone did not facilitate collaboration (Table 6.2). All participants were hesitant to trust pharmacists with whom they were unfamiliar, especially in community settings.

> *We're supposed to be doing team-based care. Team-based care means you have communication and you have some discussion about the patients. When you don't have any of those things and all you get back is faxes, you don't have a team-based care; you have just another silo of primary care, trying to create its own little empire over there. (Phy 06)*

6.6.3.1.3 Professional trust

In general, all the participants excluding one (i.e., Phy 09) evaluated pharmacist prescribing on an individual case-by-case basis instead of professional viewpoint. To develop professional trust, physicians suggested certification in prescribing for disease management or system to monitor the quality of pharmacist prescribing. One participant alluded to the notion of professional trust and said,

I'm hoping that they know the Canadian pharmacists association or the regulatory bodies that they have, colleges, actually. They can monitor that. So it's not that anybody can prescribe, so they have to go through the process of getting the prescribing medication…. (Phy 04)

One participant (i.e., Phy 09) expressed "mutual respect" toward pharmacist prescriber by trusting them as professional and their ability to prescribe.

I would assume that there's a scope of practice that a pharmacist would have that background, the education behind it, the reasoning behind why they're making those changes and that it would be somehow monitored, just as if it is with nurse practitioners. (Phy 09)

Almost half of the participant physicians raised concerns about community pharmacists' conflict of interest and this reduced their professional trust. The participants' feared that working in a commercial (i.e., pharmacy) setting would encourage pharmacists to prescribe more than they might prescribe in a clinical setting. Commenting on conflict of interest, one participant said,

If there were conflicts of interest because of, you know, pharmacists, let's say prescribing in the context of their own pharmacy, I suppose that could be a problem. (Phy 07)

6.6.3.2 Communication

All of our participants emphasized the importance of two-way, timely, and problem-solving communication.

6.6.3.2.1 Both-way communication

Most of the participants received community pharmacist communication fax. This obstructed the ability to build a relationship as well as trust. Still, all participants agreed that one-way communication (i.e. fax) to provide information about renewal prescribing was acceptable while using a fax to communicate about changing or initiating a medication was not. The participants said that phone or face-to-face conversations could initiate discussion and relationship-building with the community pharmacists:

> *A fax, it's impersonal. It doesn't build those relationships. It doesn't allow for that exchange, even if it's a brief one and that can be really important, sometimes for the education of the physician, sometimes for the education of the pharmacist, sometimes just for clarification and also it allows that relationship and trust to build so that in the future, you know…you could have more positive interactions. (Phy07)*

Most of the participants wanted the community pharmacist to initiate communication face-to-face or over the phone despite recognizing that their own time constraints made such connections challenging. Team pharmacists sometimes bridged communication between community pharmacists and the participants to resolved discrepancies. One participant (i.e., 08) said that he made himself accessible to community pharmacists and established two-way communication over the phone. This participant was salaried and worked with selected community pharmacists as a team for patients in an inner-city neighborhood.

It was easy for the participants to establish two-way communication and build a relationship with team pharmacists due to physical proximity. The two-way nature also facilitated problem-solving communication with the team pharmacists

6.6.3.2.2 Problem-solving communication

Five out of 12 physicians had discussed problems with the community pharmacists when they noticed any discrepancies with pharmacists' prescribing decisions. This communication was more collegial than confrontational and fostered an understanding of each party's rationale for prescribing and resolved misunderstandings. Exceptionally, two participants (i.e., Phy 06, phy 10) expressed an unwillingness to discuss pharmacist prescribing issues with community pharmacists and preferred contacting the patient to resolve the issue. The participants explained that they did not have the time, and did not want to risk conflict with the prescribing pharmacists.

> *I guess my fear of confrontation, I didn't want to be mean or like accusatory because I do think that she had the patient's best interest at heart. It was probably just not the wisest decision but to be honest, it's just the practice is so busy, I often just don't have time to call and confront or discuss things with the pharmacist. (Phy10*)

A team pharmacist prescriber agreed with this opinion and said,

> *If you involve them [the physician] in the discussion rather than just dropping stuff on his lap or just going ahead and doing it, he'll appreciate that more. (Pharm02)*

6.6.3.2.3 Timely communication

Most of the physicians reported that they received notification nearly every time that a pharmacist prescribed for their patients. This helped to resolve any discrepancy instantaneously and avoid possible risks:

> *They [Pharmacists] sent me a note telling me that they had changed the prescription. I was very glad for that because it was inappropriate what they had chosen, so I then changed the prescription to a different one. (Phy02)*

Although the participants appreciated the pharmacists' timely communications about prescribing, participants preferred communication before any change or before initiating new prescriptions. More than half of the participants expressed concern about the lack of communication which caused or had potential to cause confusion for both the patient and physician.

> *I have an issue with them making changes without communication and trying to assess patients without communication and making a bunch of recommendations based on whatever they decide they're going to make and so if that's appropriate or inappropriate, how do you know? (Phy 06)*

The participant physicians stressed the importance of clear, well-explained, legible communication from pharmacists to avoid complications and build a trusting relationship.

6.6.4 Participant type by level of collaboration

By analyzing the key beliefs and collaborations process of the participants with the pharmacist prescribers we identified two groups of participants- collaborative and consultative. (Table 6.1, Table 6.2) "Collaborative" participants (i.e., Phy 01, 08, 09, and 12) had frequent two-way communication with the pharmacist.(39) They trusted pharmacist as professional prescriber and delegated prescribing responsibilities toward team pharmacists. They also had mutual respect toward the team pharmacist prescribers. On the other hand, "consultative" participants (i.e., Phy 02, 03, 04, 05, 06, 07,10, and 11) wanted any pharmacists to consult before making autonomous prescribing decisions except renewal prescribing.(39) They expressed lack of awareness about pharmacists' expertise, training, and practice scope, and were less likely to trust and accept pharmacist prescribing. They were also less inclined to initiate communication with pharmacists due to time constraint specially with the community pharmacists. These physicians wanted to see

pharmacists' credentials or evidence of expertise before trusting the pharmacists to prescribe medications. (Table 6.2)

We compared participants' key beliefs and collaboration process according to the age, geographical location and years of practice of the participants but did not identify any definitive patterns.

6.7 Discussion

The collaboration process between participants and pharmacist prescribers were shaped by the participants' key beliefs about renewal versus initiating new prescription, community versus team pharmacists and being the ultimately responsible care provider. The collaboration process involved a level of trust founded on "shared knowledge," "shared goals," and "mutual respect" as well as cooperative communication strategies. The relationship between the key beliefs and collaboration process identified consultative and collaborative participants.

We found that "trust" was the main driving force to develop a collaborative relationship with the pharmacist prescriber. Our findings of trust are consistent with other literature.(25, 38, 40,41,42) The participants' level of trust was low for the community pharmacists or unfamiliar pharmacists compared to their team pharmacists with whom they worked collaboratively. This result further supports Bradely's (2012) general practitioner and community pharmacist collaboration model which stated that physicians have mutual trust with pharmacists with whom they worked in collaboration.(38) Similarly, physicians trusted internal pharmacists who provided Medication Therapy Management (MTM) compared to external ones.(43) However, our in-depth examination of the physicians' trust revealed that physical proximity, recognizing each others' expertise (i.e., shared knowledge) and developing collaborative patient care plans (i.e., shared

goal) were associated with the level of trust that physicians have in pharmacist prescribers. These findings are aligned with the Grittle's (2011) RC theory and McDonough's (2001) Collaborative Working Relationship (CWR) model.(27,44) A lack of collaboration in work processes may prevail if physicians and pharmacists do not consider each other's patient care plans and rationales and focus on their individual goals despite close proximity. It is important to understand each other's expertise and thought process while working to achieve a shared goal.(29)

In our study, pharmacists' lack of training in diagnosis was the physicians' major concern and contributed considerably to the physicians' low level of trust in pharmacists ability to initiate new prescriptions. These results corroborate the findings of several other studies on pharmacists prescribing and the physician-pharmacist collaboration.(20,21,45) However, in reality, pharmacists are not diagnosing the disease (i.e., with the exception of minor ailments such as warts or allergic rhinitis) rather they are assessing patients' conditions and selecting a medication therapy to prescribe after the disease has been diagnosed by a physician. Although there are some knowledge overlaps regarding medication, pharmacists have a different expertise than physicians. Higher collaboration can be achieved when physicians recognize pharmacists' prescribing process and skills. Renewal prescribing was possibly the most trusted prescribing activity, because it does not require diagnostic skills, nor did not pose challenges to the participants' prescribing decisions.

"Communication" was another significant factor that impacted participants' collaborations process with the pharmacist prescribers. Most of the physicians emphasized the positive impact of high frequency, two-way, and timely communication. Our findings suggest that phone or face-to-face communication are more effective modes of communication than fax, as both create the

opportunity for discussion to resolve issues. The literature provides similar evidence about communication between physicians and pharmacists.(25, 26, 38, 40 46) Bradely (2012) specifically noted that faxing is unidirectional communication and has insufficient scope to build a collaborative relationship.(38) The lack of trust in the relationship between participants and community pharmacists may be driven by the predominance of fax communication between the two parties.

Not surprisingly, two-way, problem-solving communication improved collaboration and facilitated a trustworthy relationship. In order to resolve disagreements, physicians must communicate their concerns to pharmacists instead of patients. Otherwise, the pharmacist might repeat similar prescribing practices without understanding the physician's goal of therapy, which might lead to a deterioration in the physician-pharmacist relationship. Weissenborne et al. (2017) and Snyder et al. (2010) suggested that pharmacists should initiate face to face communication to establish a relationship with the physicians before pharmacists prescribe for a physicians' patient.(47,48) This face to face communication might facilitate sharing knowledge, goals, and suitable communication strategies as well as could develop mutual respect and increase pharmacists' recognition.(29,44)

Physician's views on giving the approval to prescribe and being the main responsible health care provider hinted at distinct power differences. Although not explicitly articulated, the perception of ultimate control over patient care and prescribing indicated a sense of medical dominance.(49) This finding further supported previous literature that described physician's medical dominance and professional power.(49,50) Participants expectation that pharmacists ask before prescribing is similar to the "knock on door" policy described by Cooper et al. 2011 whereby physician encouraged supplementary prescribers to seek advice before prescribing especially in the early

stage of prescribing practice.(51) This allowed participants the opportunity to evaluate individual pharmacists prescribing rationale and expertise. The provincially granted prescribing authorization was not adequate for physicians to trust a pharmacists' prescribing expertise. Greater collaboration achieved when participants trusted the profession of pharmacists as prescribers and delegated prescribing responsibilities toward them. Similarly, RC theory posits that effective coordination cannot be achieved where there is a lack of mutual respect and collegiality.(29) However, physicians are trained to take the leadership position in teams as well as responsibility for the care provided by any non-physicians in the team.(52,53) Challenges to this leadership may threaten physician autonomy.

Conventional practice is moving towards more collaborative and team-based practice gradually to improve patient outcome, access, and satisfaction as well as to reduce physicians' workload. Our "collaborative" participants in our study exhibited a greater level of collaboration, trust, communication and collegial relationship with their team pharmacists which is supported by the other literature on CWR model.(38, 39, 40, 44) Participants had shared goals, shared knowledge, and mutual respect in addition to the good quality of communication with the team pharmacists which facilitated their relational coordination and they were willing to delegate prescribing responsibilities toward team pharmacists. On the contrary, "consultative" participants were still hesitant to delegate prescribing responsibilities toward any pharmacists including team pharmacists.

We found gaps in these physicians' understanding the pharmacists prescribing expertise, and the communication strategies to foster collaboration as well as building a trustworthy relationship with these pharmacists. Therefore, we developed three educational infographic tools to disseminate our findings in the context of a practical setting and foster collaboration between

physicians and prescribing pharmacists. The first tool is an educational infographic illustrating how pharmacist prescribing fits into family physicians' practices (Figure 6.1). This tool designed to promote physicians' understanding of pharmacists' scope of practice and physicians' integration into the pharmacist prescribing process. The second tool lists communication tips for both physicians and pharmacists (Figure 6.2). These tips might help to foster the collaborative communication between pharmacists and physicians. The third addresses some myths that we found in our data and includes similar facts (Figure 6.3). This tool will help to reduce hypothetical misbeliefs about pharmacist prescribing.The findings might give valuable insight into interprofessional communication and can be used to inform strategies to optimize a collaborative relationship between prescribing pharmacists and family physicians.

6.7.1 Trustworthiness

Throughout the data collection and analysis procedure, we exercised extensive reflexivity to deal with our biases. A research team consisting of a physician and pharmacist helped us to reflect on our own interpretations and made us aware of our biases. The interpretations were peer-reviewed by two co-investigators to establish the credibility of the findings.(54, 55) We also used a triangulation method to determine the credibility of our research. We employed multiple sources of data by interviewing physicians and "team pharmacists" who were working with participants as team members. We used a maximum variation sampling method to make our results resonate in different contexts. To ensure transferability, we used a thick, rich description to explain our findings. Memos and field notes helped us to reflect on assumptions and refine our understandings of the findings.(54-56). The iterative process of data analysis starting after the first interview helped us to be reflexive, adapt our interview guide, ensure purposeful sampling, and develop the meaning of the data. We also reported negative or disconfirming evidence. The

participants shared not only their perceptions but also their practical experiences with pharmacist prescribing. This provided us with more realistic findings than hypothetical beliefs.

6.7.2 Limitations

We narrowed our focus to family physicians' perceptions only. Our findings lacked input from other physicians who work with prescribing pharmacists —specialists, dentists, optometrists. Therefore, the findings do not reflect the views of all types of physicians in Alberta. Other health care professionals, such as nurses, physiotherapists, and occupational therapists, might provide more diverse perspectives and experiences about pharmacists. We did not apply the member checking method to improve the study credibility as our participants are highly occupied with their practice and it was difficult to arrange a follow-up.

6.7.3 Implications

Our findings suggested a need for developing communication strategies between physicians and community pharmacists. Team pharmacists could play a vital role to fill the gaps between community pharmacists and physicians. Professional organizations may step up to increase awareness of pharmacist' expanded scope of practice and integration process of other healthcare providers in the patient care.

Our findings also have implications for research. A case-controlled study can be designed to evaluate the effectiveness of communication models between physicians and pharmacist prescribers in a real practice setting. Further research may explore patients' experiences regarding collaboration between their physicians and prescribing pharmacists. Educational tools can be developed from our study to improve the collaboration between physician and pharmacist prescribers.

6.8 Conclusion

We found physicians were more likely to accept prescribing activities of pharmacists with whom they worked in collaboration and had trust, collegial relationships, and high-quality communications. Physicians were partially aware of pharmacists' scope of practice and hesitant to accept de novo prescriptions initiated by pharmacists. Established prescribing expertise and communication fostering strategies should facilitate collaborative relationships between physicians and pharmacist prescribers. The findings of the study should provide insight into interprofessional communication and can be used to inform strategies to optimize collaborative relationships between pharmacist prescribers and physicians.

6.9 References

1. Manca DP, Varnhagen S, Brett-MacLean P, Allan GM, Szafran O, Ausford O, et al. Rewards and challenges of family practice. *Can Fam Physician.* 2007; 53(2):277-286;
2. Yarnall KSH, Østbye T, Krause KM, Pollak KI, Gradison M, Michener JL. Family physicians as team leaders: "time" to share the care. *Prev Chronic Dis*. 2009;6(2):A59-A64.
3. Yarnall KSH, Pollak KI, Østbye T, Krause KM, Michener JL. Primary care: is there enough time for prevention? *Am J Public Health*. 2003 Apr; 93(4):635-641.
4. Ostbye T, Yarnall KSH, Krause KM, Pollak KI, Gradison M, Michener JL. Is there time for management of patients with chronic diseases in primary care? *Ann Fam Med*. 2005;3(3):209-214.
5. Mawardi BH. Satisfactions, dissatisfactions, and causes of stress in medical practice. *JAMA.* 1979;241(14):1483-6.

6. Tamblyn R, Berkson L, Dauphinee WD, Gayton D, Grad R, Huang A, et al. Unnecessary prescribing of NSAIDs and the management of NSAID-related gastropathy in medical practice. *Ann Intern Med*. 1997;127(6):429-38.
7. Lin CT, Albertson GA, Schilling LM, Cyran EM, Anderson AN, Ware L, Et al. Is patients' perception of time spent with the physician a determinant of ambulatory patient satisfaction? *Arch Intern Med.* 2001;161:1437-1442
8. Kaplan SH, Greenfield Sm Gandek B, Rogers WH, Ware JE Jr. Characteristics of physicians with participatory decision-making styles. *Ann Intern Med*. 1996;124:497-504
9. Altschuler J, Margolius D, Bodenheimer T, Grumbach K. Estimating a Reasonable Patient Panel Size for Primary Care Physicians With Team Based Task Delegation. *Ann Fam Med*. 2012;10:396-400.
10. Latter S, Blenkinsopp A. Non-medical prescribing: current and future contribution of pharmacists and nurses. *Int J Pharm Pract.* 2011; 19:381-2
11. A Guide to Good Prescribing Practice for Prescribing Pharmacists in Scotland- NHS Education for Scotland. [Updated 2012 Jul; cited 2017 Jun 15]. Available from: http://www.nes.scot.nhs.uk/media/1457463/nesd0061_goodprescribingpractice.pdf
12. McBane SE, Dopp Al, Abe A, Benavides S, Chester EA, Dixon DL, Dunn M, Johnson MD, Nigro SJ, Rothrock-Christian T, Schwartz AH, Thrasher K, Scot W. Collaborative Drug Therapy Management and Comprehensive Medication Management. *Pharmacother.* 2015; 35(4):e39–e50
13. Ukens C. Florida VA pharmacists pioneer independent prescribing, Hosp Pharm. 1997; (11):33.

14. Pharmacist Prescriber Scope of Practice, Pharmacy Council of New Zealand 2013. [updated 2013 April; cited 2017 May 20]. Available from: http://www.pharmacycouncil.org.nz/Portals/12/Documents/prescribers/NZ%20Pharmacist%20Prescriber%20Scope%20of%20Practice%20FINAL.pdf?ver=2017-02-20-125642-553
15. Hoti K, Hughes J, Sunderland B. An expanded prescribing role for pharmacists-an Australian perspective. AMJ. 2011;4(4):236-242.
16. Pharmacists' Expanded Scope of Practice in Canada, Canadian Pharmacists Association. [Updated 2016 Dec; cited 2017 May 25]. Available from: http://www.pharmacists.ca/index.cfm/pharmacy-in-canada/scope-of-practice-canada/
17. Yuksel N, Eberhart G, Bungard TJ: Prescribing by pharmacists in Alberta. Am J Health Syst Pharm. 2008; 65(22):2126–2132.
18. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Yuksel N. Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. Implement Sci. 2013; 8(1):109
19. Child D, Cantrill JA. Hospital doctors' perceived barriers to pharmacist prescribing. *Int J Pham Pract.*1999;7:230-7
20. Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. Int J Pham Pract. 2009; 17(2): 89-94.
21. Woolfrey S, Dean C, Hall H, Hospital pharmacist prescribing: a pilot study. Pharm J. 2000; 265 (7105):97-99

22. Hatah, E, Braund, R, Duffull, SB, Tordoff; J. General practitioners' views of pharmacists' current and potential contributions to medication review and prescribing in New Zealand. *J Prim Health Care* .2013;5(3):223–233

23. Blenkinsopp A, Tann J, Evans A, Grime J. Opportunity or threat? General practitioner perceptions of pharmacist prescribing. *Int J Pham Pract.* 2008; 16(1):29-34.

24. Henrich N, Joshi P, Grindrod KA, Lynd LD, Marra CA. Family Physicians' Perceptions of Pharmacy Adaptation Services in British Columbia. *Can Pharm J* (Ott). 2011; 144(4):172-178.

25. Donald M, King-Shier K, Tsuyuki RT, Al Hamarneh YN, Jones CA, Manns B, et al. Patient, family physician and community pharmacist perspectives on expanded pharmacy scope of practice: a qualitative study. *CMAJ Open.* 2017; 5(1) , E205-E212

26. Schindel TJ, Yuksel N, Breault R, Daniels J, Varnhagen S, Hughes CA. Perceptions of pharmacists' roles in the era of expanding scopes of practice. *Res Social Adm Pharm.* 2017; 13(1): 148–161.

27. Gittell JH. Relational Coordination: Guidelines for Theory, Measurement and Analysis, Revised: August 25, 2011. [Updated 2011; cited 2017 Jun 20]. Available from: (http://rcrc.brandeis.edu/downloads/Relational_Coordination_Guidelines_8-25-11.pdf)

28. Glanz K, Rimer BK, Viswanath K. *Health Behavior and Health Education: Theory, Research, and Practice*.4th ed. San Francisco, CA: Jossey-Bass; 2008.

29. Gittell JH. Relationships between service providers and their impact on customers. *J Serv Res*. 2002; 4(4):299-311.

30. Cramm JM, Nieboer AP. Relational coordination promotes quality of chronic care delivery in Dutch disease-management programs. *Health Care Manage Rev.* 2012; 37(4): 301-309

31. Gittell JH, Fairfield KM, Bierbaum B, Head W, Jackson R, Kelly M, et al. Impact of Relational Coordination on Quality of Care, Postoperative Pain and Functioning, and Length of Stay: A Nine-Hospital Study of Surgical Patients. *Med Car.* 2000; 38(8):807-819

32. Mertens DM. Research methods in education and psychology: *Integrating diversity with quantitative and qualitative approaches.* Thousand Oaks, CA: Sage 1998

33. Thorne S, Kirkham SR, MacDonald-Emes J. Focus on Qualitative Methods Interpretive Description: A Noncategorical Qualitative Alternative for Developing Nursing Knowledge. *Res Nurs Health*. 1997; 20(2):169–177.

34. Hunt MR. Strengths and challenges in the use of interpretive description: reflections arising from a study of the moral experience of health professionals in humanitarian work. *QHR.* 2009; 19(9): 1284-1292.

35. The health professional's guide to pharmacist prescribing: Alberta College of Pharmacists. [Updated 2012 Sep; cited 2017 Jun 17]. Available from: https://pharmacists.ab.ca/sites/default/files/HPGuidePrescribing.pdf

36. Thorne SE. Interpretive description. Walnut Creek, CA: Left Coast Press; 2008

37. Thorne S, Data analysis in qualitative research, *Evidence-Based Nursing* 2000;3:68-70.

38. Bradley F, Ashcroft DM, Noyce PR. Integration and differentiation: a conceptual model of general practitioner and community pharmacist collaboration. *Res Social Adm Pharm*. 2012;8(1):36-46.

39. Boon H, Verhoef M, O'Hara D, Findlay B. From parallel practice to integrative health care: a conceptual framework. *BMC health*. 2004;4(1):15.

40. Bardet JD, Vo TH, Bedouch P, Allenet B. Physicians and community pharmacists collaboration in primary care: A review of specific models. *Res Social Adm Pharm*. 2015;11(5):602-22.

41. Liu Y, Doucette WR, Farris KB. Examining the development of pharmacist-physician collaboration over 3 months. *Res Social Adm Pharm*. 2010;6(4):324-33.

42. Liu Y, Doucette WR. Exploring stages of pharmacist–physician collaboration using the model of collaborative working relationship. *J Am Pharm Assoc (2003).* 2011;51(3):412-9a.

43. Hager K, Uden D, Tomaszwski D. Bridging the location gap: How can pharmacists and physicians collaborate to provide patient care. *J Res Interprof Pract Educ*. 2015;5(2):1-14.

44. McDonough R, Doucette W. Developing collaborative working relationships between pharmacists and physicians. *J Am Pharm Assoc.* 2001;41(5):682-92.

45. Rubio-Valera M, Jové AM, Hughes CM, Guillen-Solà M, Rovira M, Fernández A. Factors affecting collaboration between general practitioners and community pharmacists: a qualitative study. *BMC Health.* 2012; 12(1):188

46. Kelly DV, Bishop L, Young S, Hawboldt J, Phillips L, Keoug TM. Pharmacist and physician views on collaborative practice: Findings from the community pharmaceutical care project. *Can Pharm J (Ott).* 2013; 146(4):218-26.

47. Weissenborn M, Haefeli WE, Peters-Klimm F, Seidling HM. Interprofessional communication between community pharmacists and general practitioners: a qualitative study. *Int J Clin Pharm.* 2017;3(39):495-506.
48. Snyder ME, Zillich AJ, Primack BA, Rice KR, McGivney MA, Pringle JL, Smith RB. Exploring successful community pharmacist-physician collaborative working relationships using mixed methods. *Res Social Adm Pharm*. 2010;6(4):307-23.
49. Weiss MC, Sutton J. The changing nature of prescribing: pharmacists as prescribers and challenges to medical dominance. *Sociol Health Ill.* 2009;31(3):406-21.
50. Weiss MC, Platt J, Riley R, Horrocks S. GPs, nurses and pharmacists as prescribers in primary care: an exploration using the social identity approach. *IJHP*. 2016;3(2):153-64.
51. Cooper RJ, Bissell P, Ward P, Murphy E, Anderson C, Avery T, et al. Further challenges to medical dominance? The case of nurse and pharmacist supplementary prescribing. *Health:.* 2012;16(2):115-33.
52. Chadi N. Medical Leadership: Doctors at the Helm of Change. *MJM*. 2009; 12(1):52-57
53. Aerde JV. Physician leadership development, Alberta Health service. 2013
54. Merriam S. *Case study research in education: A qualitative approach*. San Francisco: Jossey-Bass Edition 1. 1988.
55. Lincoln YS, Guba EG *Naturalistic inquiry*. Beverly Hills, CA: Sage. 1985
56. Erlandson DA, Harris EL, Skipper B L, Allen S D. *Doing naturalistic enquiry: A guide to methods.* Newbury Park, CA: Sage. 1993

Table 6.1 Participants' Demographic Information and Type Based on Collaboration Level

Participant type by level of collaboration	Physicians ID	Gender	Years in Practice	Practice setting	Specialization	Geographical locations	Comments
Collaborative	01	M	35	Primary care network (PCN)*	Family medicine	Urban	Worked with team pharmacist
	08	M	16	Community clinic	Family medicine, Addiction	Urban, Inner city	Salaried, Worked with community pharmacists as a team
	09	F	16	Community clinic	Family medicine	Urban	Worked with team pharmacist

	12	M	3	PCN	Family medicine	Rural	Works with team pharmacist
Consultative	02	F	16	PCN	Family medicine	Urban	Worked with team pharmacist
	03	F	6	PCN	Family medicine	Urban	Worked with team pharmacists
	04	F	11	Community hospital	Geriatric	Urban	Worked with team pharmacist
	05	M	4	Community clinic, nursing home	Family medicine	Urban	Worked with team pharmacists in nursing home
	06	M	35	PCN	Family medicine	Urban	Worked with team pharmacist
	07	F	3	Mental	Mental health	Urban	Worked as

				hospital, Community clinic			community pharmacist before being physician and worked with team pharmacist in hospital
	10	F	1	Community clinic	Family medicine	Urban	Locum and did not have team pharmacist
	11	M	8	PCN, Community hospital	Family medicine	Rural	Worked with team pharmacists in hospital, PCN does not have pharmacist

*Primary Care Network (PCN): A Primary Care Network is a network of doctors and other health providers such as nurses, dietitians and pharmacists working together to provide primary health care to patients.

Table 6.2 Participant Type by Level of Collaboration and Their Collaborative Characteristics

	Consultative	Collaborative
Trust	• High level of trust in renewal prescribing by any pharmacist • Low level of trust on initiating prescription or changing medication by any pharmacists and warrant consultation before prescribing • Trust team pharmacist for drug therapy related consultations and suggestions	• High level of trust in renewal prescribing by any pharmacist • High level of trust on team pharmacists for initiating or changing medication
Communication	• One way communication is sufficient for renewal prescribing • Two way communications were warranted for initiating or changing medication • Expect pharmacist (both team and community) to initiate communication before initiating or changing medication	• One way communication is sufficient for renewal prescribing • Easily accessible to the pharmacists and take initiative to establish two way communication
"I am responsible"	• Not willing to delegate prescribing responsibility excluding renewal prescribing toward any pharmacists	• Take responsibility of diagnosis and delegate responsibility of prescribing toward team pharmacists

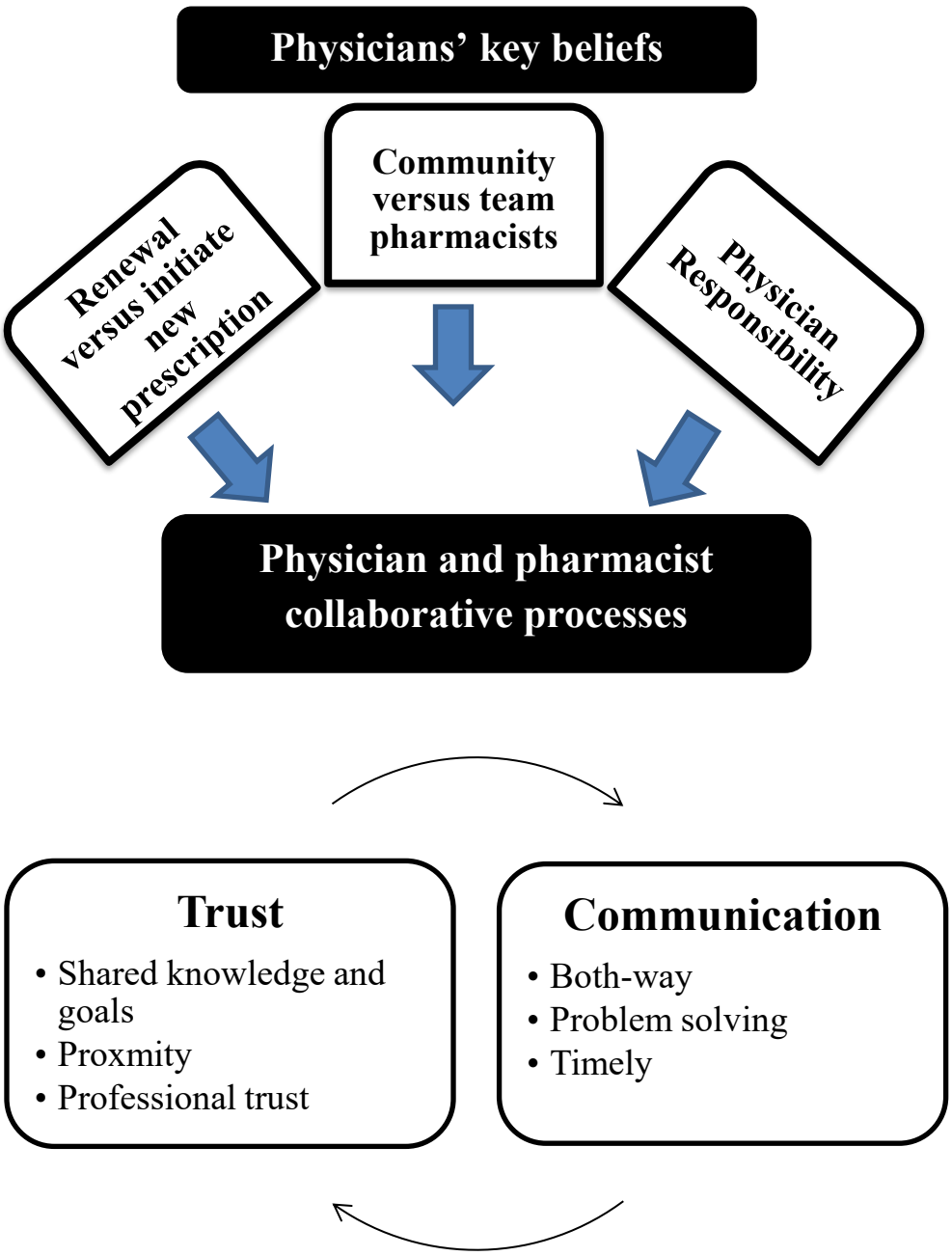

Figure 6.1 Physician and Pharmacist Prescriber Collaborative Model

Chapter Seven

Discussion and future direction

7.1 Summary of research

The overall objective of this thesis was to explore factors that impacted pharmacist prescribing adoption in Alberta using Diffusion of Innovation (DoI) theory. First, we started with the scoping review (Chapter 2) to characterize existing peer-reviewed literature on pharmacist prescribing in Canada according to the research area, key findings, and methodological trends and to find gaps in research. We found that mostly quantitative methods were applied and patient healthcare outcome measures were the major focus. Gaps were found in the evaluation of pharmacist prescribing adoption process, impact on physicians' practice, comparison of prescribing practice across provinces, and its impact on the economy system.

The second study (Chapter 3) described the survey questionnaire development procedure to explore pharmacist prescribing adoption. Our research team developed the survey questionnaire using previous literature and findings of a qualitative study on pharmacists in Alberta.(1) The research team involved stakeholders, experts, and pharmacists to establish the content validity of the questionnaire. The final questionnaire was administered to 700 randomly selected practicing pharmacists in Alberta and response rate was 54.6%. We ran exploratory factor analysis to establish convergent validity and reliability of five scales- self-efficacy in prescribing, support from practice, impact on practice, prescribing beliefs, and use of Electronic Health Record (EHR). All the scales had moderate to strong evidence of validity and reliability. We used these scales as potential factors to predict pharmacist prescribing adoption in the study described in chapter five.

In the third study (Chapter 4), we conducted a secondary analysis of the survey data developed and administered by our research team to explore pharmacist prescribing adoption.(1) In this study, we characterized pharmacist prescribers using cluster analysis according to their self-reported prescribing practice. We found three types of prescribers- "Renewal prescriber", "Modifier", and "Wide ranged prescriber". The "Renewal prescriber" mainly prescribed for the continuation of the therapy for their patients. This group comprised the largest portion (74%) of pharmacist prescribers and was predominantly practicing in the community setting. "Modifiers" was the second largest group (17%) and primarily adapted prescription by altering the dose or regimen and substituting medications within similar therapeutic classes. The majority of "Modifiers" were practicing in collaborative settings. Finally, the "Wide ranged prescriber" (9% of pharmacists) were practicing all types of prescribing (i.e., renewal, emergency, altering dose, altering formulation, substituting medications within similar therapeutic classes, and substituting medications due to commercial unavailability). "Wide ranged prescriber" were found similarly in both community and collaborative settings.

The fourth study (Chapter 5) explored factors that significantly predicted pharmacist prescribing frequency and types. In this study, we applied four out of eight features of DoI theory (i.e., system readiness, communication and influence, pharmacists as adopter, and prescribing as innovation).(2) We did not include rest of the features of DoI theory due to the absence of external and organizational views in the survey questionnaire.(2) We ran hierarchical multiple regression and sequential logistic regression analysis to predict frequency and types of adoption respectively. For the type of adoption, we collapsed "Wide ranged prescriber" and "Modifiers" from the cluster analysis as "Multifaceted prescriber" since both were practicing multiple types of prescribing and were distinct from "Renewal prescribers" who focused on one type of

prescribing. Multifaceted prescribers were considered as a higher adopter of prescribing than the renewal prescriber as a broader range of prescribing behaviors were adopted.

Pharmacists in a community setting prescribed more frequently than those in a collaborative setting. Pharmacists with a higher level of prescribing self-efficacy, support for practice, and longer experience adopted a higher frequency prescribing. While exploring types of prescribing adoption, we found pharmacists in collaborative setting and with a higher level of prescribing self-efficacy were more likely to adopt "Multifaceted prescribing." Exploring both the frequency and type of prescribing provided us with a profound understanding of prescribing adoption. Self-efficacy was the strongest predictor of prescribing frequency while practice setting was the key predictor of types of prescribing. The practice setting was also highly correlated with the relationship of pharmacists with the physicians. Therefore, the physician-pharmacist relationship should also shape the pharmacist prescribing adoption process and is supported similar findings from qualitative analysis of pharmacist prescribing conducted by our research team.(3)

In the fifth study, we conducted a qualitative research to understand the physicians' perceptions of pharmacist prescribing. This study provided us with the opportunity to explore organizational and collaboration aspect of "outer context" feature of the DoI theory.(2) We interviewed 12 family physicians who had experience with pharmacist prescribing for their patients. We applied the Interpretive Description method in data collection and analysis.(4) Relational Coordination (RC) theory guided us to understand the collaboration process between participants and pharmacist prescribers. Participants' showed distinct beliefs about renewal versus initiating new prescription, and community versus team pharmacist. They also believed themselves as the main responsible health care providers. The participant-pharmacist prescriber collaboration evolved through participants' trust and communication strategies with individual pharmacist prescribers

and also shaped by the participants' key beliefs. We identified "consultative" and "collaborative" types of participants based on their level of collaboration with pharmacist prescribers. Both types of participants trusted renewal prescribing by both community and team pharmacists, but trusted team pharmacists more than community ones. Consultative participants lacked trust in pharmacists' ability to initiate prescription or change prescriptions and preferred consultation before prescribing. On the other hand, collaborative participants had greater acceptance of prescribing activities by team pharmacists and shared prescribing responsibilities with them. All the participants believed diagnosis was their sole responsibility and pharmacists lacked this skill. Participants had a low level of awareness about pharmacists' full scope of prescribing and communication strategies to foster collaboration.

7.2 Discussion

DoI theory provided a framework to understand both the quantitative and qualitative research on pharmacist prescribing adoption in Alberta. System readiness is comprised of the practice setting and support from practice and significantly affected pharmacist prescribing adoption. DoI theory suggests higher adoption when an innovation is compatible with the organization's current system. (2,5,6) Similarly, renewal prescribing was highly compatible with the community setting as it was similar to prior practices pharmacists used to lend medication to the patient.(3) Thus, we found a greater adoption of renewal prescribing in the community settings. On the other hand, multifaceted prescribing including altering the dose and regimen or substituting a medication is an integral part of pharmacist prescribing in hospital or consultation possibly due to more suitable practice environment for multifaceted prescribing such as access to patient information, availability of time and resources, easy communication with the physician. Finally, support from the social system activates the process of diffusion (7,8) and our results seem to be

consistent as pharmacists who received positive prescribing expectation from employers and patients prescribed more frequently.

Prescribing self-efficacy and year of experience significantly predicted pharmacist as an adopter. The literature on the diffusion of innovation suggests adopter's cognitive and social psychology such as specific skill, motivation confidence, intellectual ability, values, and motivation influence the adoption rate. Early adopters are ready to select ideas and accept the risk to implement innovation.(6,7) Similarly, in our study, pharmacists with a higher level of self-efficacy maybe had greater risk tolerance and that is why they tried higher frequency and multifaceted prescribing. Previously, pharmacists used informal renewal prescribing by requesting the physician authorize refills and often made suggestions to optimize medication therapy; therefore, it is not surprising that pharmacists with greater practice experience adopted a greater frequency of prescribing.

The impact of the innovation itself is a major features of DoI theory.(2,6,7) Specifically, adopters become motivated to adopt an innovation when they recognize relative advantages of the innovation.(2,6,7) Our results of the quantitative study differ in this regard as the benefits of prescribing did not significantly predicted the adoption. A possible explanation of this might be that prescribing was legitimized pharmacists' prior practice, and the benefit were not novel.(3) Additionally, due to the independent nature of prescribing in Alberta (9) pharmacists may be more affected by their own attributes, the practice environment and relevant practice supports.

DoI theory highlights how communication and interpersonal influence directly impact diffusion whereas the nature of our data only allowed for an indirect assessment of the relationship between adoption and communication.(2) Pharmacists' communication with physicians and

interprofessional health care providers were highly correlated with the practice setting due to the organizational arrangement of the Canadian health care system. Thus, communication variables were eliminated from the analysis to prevent multicollinearity. As a result, the significant influence of practice setting on prescribing adoption may also imply that communication and influence of physician and other healthcare provider impacted pharmacist prescribing adoption in Alberta. This is also supported by other literature on prescribing.(3)

Outer context feature of DoI theory explains that diffusion of innovation is accelerated when the interorganizational network promotes diffusion and providers of professionally linked networks have shared goals and values.(2,10,11) In our qualitative study (Chapter 6), physicians accepted renewal prescribing by pharmacists which should promote the renewal prescribing adoption. Furthermore, physician shared their patients with the team pharmacists, and thus supported diffusion of a higher level of prescribing with the team pharmacists. Our qualitative study suggests that collaboration level played a vital role in physician's acceptance of the pharmacist prescribing role.

The results of our qualitative study (Chapter 5) were complementary to those of our quantitative study (Chapter 6). Our quantitative study suggested the majority of the pharmacists were prescribing renewal focused prescribing, and they are mostly from the community setting. Evidence of physicians' well acceptance of renewal prescribing in our qualitative study might be one of the factors that encouraged the pharmacists to adopt renewal focused prescribing confidently. The positive feedback from the physicians should encourage pharmacists to prescribe more frequently.(2,7) Then again, physicians' trust level and acceptance might be increased by the frequent successful renewal prescribing by pharmacists. Furthermore, physicians' higher level of trust of team pharmacists possibly facilitated team pharmacists''

multifaceted prescribing adoption (i.e. greater level of adoption). On the contrary, physicians' lack of acceptance of prescribing and absence of effective communication strategies with the community pharmacists impeded the uptake of multifaceted prescribing by them (i.e., community pharmacist).

7.3 Proof of validity

7.3.1 Measurement validity

Measurement validity is the assessment of the degree to which the tool measures what it is intended to measure.(12) In our quantitative study, the survey tool has evidence for validity and reliability because the content expert, cognitive interview, and a pilot study were used to develop the instrument. The initial instrument was revised using feedbacks from five expert pharmacists and findings from cognitive interviews of pharmacists and hence, the content validity of the instrument was established. Questions were designed based on the pharmacy practice in Alberta. We established construct validity using factor analysis and scale correlations. Internal reliability was established by using Cronbach's alpha.(13) We also looked at the intercorrelation among the measures of our study and compared with the established correlation in the previous literature to validate our measures. For example, we measured self-efficacy belief of pharmacists in prescribing. Thus, we had evidence of validity that the survey items (i.e., self-efficacy toward prescribing) were representative of the construct of interest (i.e., prescribing behaviours). There was a potential threat of measurement validity as we used self-reported responses to answer the research questions.

7.3.2 Statistical conclusion validity

Statistical conclusion validity is the assessment of the suitability of using statistical techniques and appropriateness of the inference drawn from the statistical analysis.(12) In our quantitative study, we used multiple regression analysis which was appropriate as we had multiple independent variables and one continuous dependent variable. Logistic regression was also appropriate as we had dichotomous dependent variables and combination of continuous and categorical independent variables. We had evidence for the validity of our statistical analysis as we met the required assumptions of the analysis. We checked the absence of outliers, multicollinearity, normality, homoscedasticity of the residuals, the ratio of cases to IVs, the linear relationship among DVs and IVs for multiple regression and logistic regression analysis.

7.3.3 Internal validity

Internal validity refers to the extent to which a study can measure the causal relationship among the variables. (12) In our quantitative study, we used observational and cross-sectional design; therefore, we cannot draw conclusions about the causal relationships as there may be other explanations for any observed relationship.

7.3.4 External validity

External validity measures the degree of generalizability of the findings of a study to the population or settings.(12) In the quantitative study, external validity was considered from the study sample to the population of Albertan pharmacists. Participant biases were avoided by random selection of pharmacists on the Alberta College of Pharmacists registry. Our data only captured information from Albertan pharmacists and our findings are not generalizable to the pharmacists in other jurisdictions. We used cluster analysis to group the pharmacists depending on their type of prescribing practice. Cluster analysis is descriptive, non-theoretical, and non-

generalizable. Cluster solution depends on the variables used to characterize the groups. Therefore, there was a threat of external validity as the inference was only applicable for the participants of the study.

7.3.5 Validity of the qualitative study

The trustwortyhiness of the qualitative study was achieved by describing results from participants' perspective. Coding by two researchers also increased the trustworthiness of our study. Evidence of trustworthiness confirmed the internal validity of our study.

The study was not intended to be generalizable but we ensured transferability by giving a thick rich description of the context and assumptions about our findings so others can interpret our findings in different but similar context. We also used triangulation, memos and field notes to establish dependability of our study.

7.4 Limitations

We did not apply three features of DoI theory- system antecedents, implementation process, and linkages between design and implementation stages. Application of all eight features could provide a comprehensive understanding of pharmacist prescribing adoption. Our results of both quantitative and qualitative studies are based on the data from one jurisdiction of Canada. Therefore, findings can only be generalized to the Albertan pharmacists and family physicians. Due to a very low response rate of the APA pharmacists in the quantitative study, we could not explore factors predicting adoption of initiating new prescriptions. Our qualitative study was only focused on collaboration with family physicians. Our study did not explore collaboration of pharmacist prescribers with other physicians (i.e. specialists) as well as other healthcare providers in the system such as dentists, nurses, physiotherapists, mental health therapists, and

dieticians. We also did not evaluate pharmacists' and physicians' payment model and its impact on prescribing adoption and interprofessional collaboration.

7.5 Implications

This thesis suggests important factors that affected pharmacist prescribing adoption. Our findings should have implications for pharmacy research, pharmacy practice, and policy-makers.

7.5.1 Pharmacy Research

Diffusion is unplanned and informal, whereas, dissemination is planned, formal and centralized.(2) Our research findings have potential to inform further research to disseminate pharmacist prescribing into practice. Interventions should take into account the pharmacist prescribers' needs, the structure of practice settings, and interprofessional communication strategies. Evidence in the literature, including our findings, provides insight into interprofessional collaboration models. Future research should examine the implementation of these models into practice to facilitate prescribing adoption. Further research may evaluate the relational dynamics of pharmacist prescribers and patients. Research can also focus on clinical reasoning process while pharmacists are prescribing which can inform pharmacist prescribers' clinical assessment skill in practice.

During the quantitative data collection, pharmacists had been prescribing for six years. It would be more meaningful to evaluate system antecedents, implementation process, and linkages between design and implementation stages features of DoI theory at the early stage of the implementation of prescribing. Research can be done by focusing on these features in the jurisdictions who have newly implemented pharmacist prescribing or planning to implement in the near future.

7.5.2 Pharmacy Practice

Pharmacists should step up and adopt multifaceted prescribing to establish their professional role as prescribers. Professional organizations may consider designing different supportive strategies specific to community, hospital, and consultancy setting. Support for community pharmacists should recognition of clinical pharmacists in the community setting and development of interprofessional collaboration strategies. Pharmacists in the hospital or consultancy setting need to increase prescribing frequency and assume relevant prescribing responsibilities to ease physicians' burden.

7.5.3 Policy-Makers

Diffusion of prescribing in Alberta took place gradually. Policy makers may wish to move from a stance of "make it happen" rather than "let it happen" to take control over the implementation of prescribing into practice.(2) Incorporation of evaluation and monitoring plan to achieve the specific goal from pharmacist prescribing service might be a controlling mechanism of the diffusion. (2,6) Other jurisdictions that are planning to implement pharmacist prescribing should focus on a planned, formal, and centralized approach to achieve faster diffusion of pharmacist prescribing. Furthermore, lack of awareness of pharmacist prescribing among Albertan physicians provides evidence suggests inadequate engagement and integration of this key stakeholder during the implementation. Policy makers should develop strategies that will facilitate the integration of potential stakeholders of pharmacist prescribing.

7.6 Conclusion

This thesis explored pharmacist prescribing adoption process in Alberta. Policy makers, researchers, and pharmacists themselves can play a prospective role in establishing pharmacist prescribing culture and institute prescribing as an accepted part of pharmacists' role in the

healthcare system. The Albertan pharmacist prescribing model is a prototype for other jurisdictions that are considering how to employ pharmacists' skill and expertise to enhance healthcare delivery.

7.6 References

1. Guirguis LM, Hughes CA, Makowsky M, Sadowski C, Schindel T, Yuksel N. Survey of Pharmacist Prescribing Practices in Alberta. Am J Health Syst Pharm. 2017; 74:(2):62-69
2. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: Systematic review and recommendations. Milbank Q. 2004;82(4):581-629.
3. Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N. Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. Implement Sci. 2013; 8(1):109
4. Gittell JH. Relational Coordination: Guidelines for Theory, Measurement and Analysis. [Updated 2011 Aug 25; cited 2017 Jun 20]. Available from: (http://rcrc.brandeis.edu/downloads/Relational_Coordination_Guidelines_8-25-11.pdf)
5. Gustafson DH, Sainfort F, Eichler M, Adams L, Bisognano M, Steudel H. Developing and testing a model to predict outcomes of organizational change. *Health Serv Res.* 2003;38(2):751-76.
6. Rogers EM. Diffusion of innovations. 1995
7. Berwick DM. Disseminating innovations in health care. *JAMA*. 2003;289(15):1969-75.
8. Cain M, Mittman R. Diffusion of innovation in health care. 2002
9. Law MR, Ma T, Fisher J, Sketris IS. Independent pharmacist prescribing in Canada. Can Pharm J (Ott). 2012;145(1):17-23.

10. Granovetter M, Soong R. Threshold models of diffusion and collective behavior. *J Math Sociol.* 1983;9(3):165-79.
11. Valente TW. Social network thresholds in the diffusion of innovations. *Soc. Networks*. 1996;18(1):69-89.
12. Cor MK. Trust me, it is valid: Research validity in pharmacy education research, *Curr Pharm Teach Learn* 2016; 8 (3): 391-400
13. Bland J, Altman D. Statistics notes: Cronbach's alpha. *BMJ* 1997;314:275.

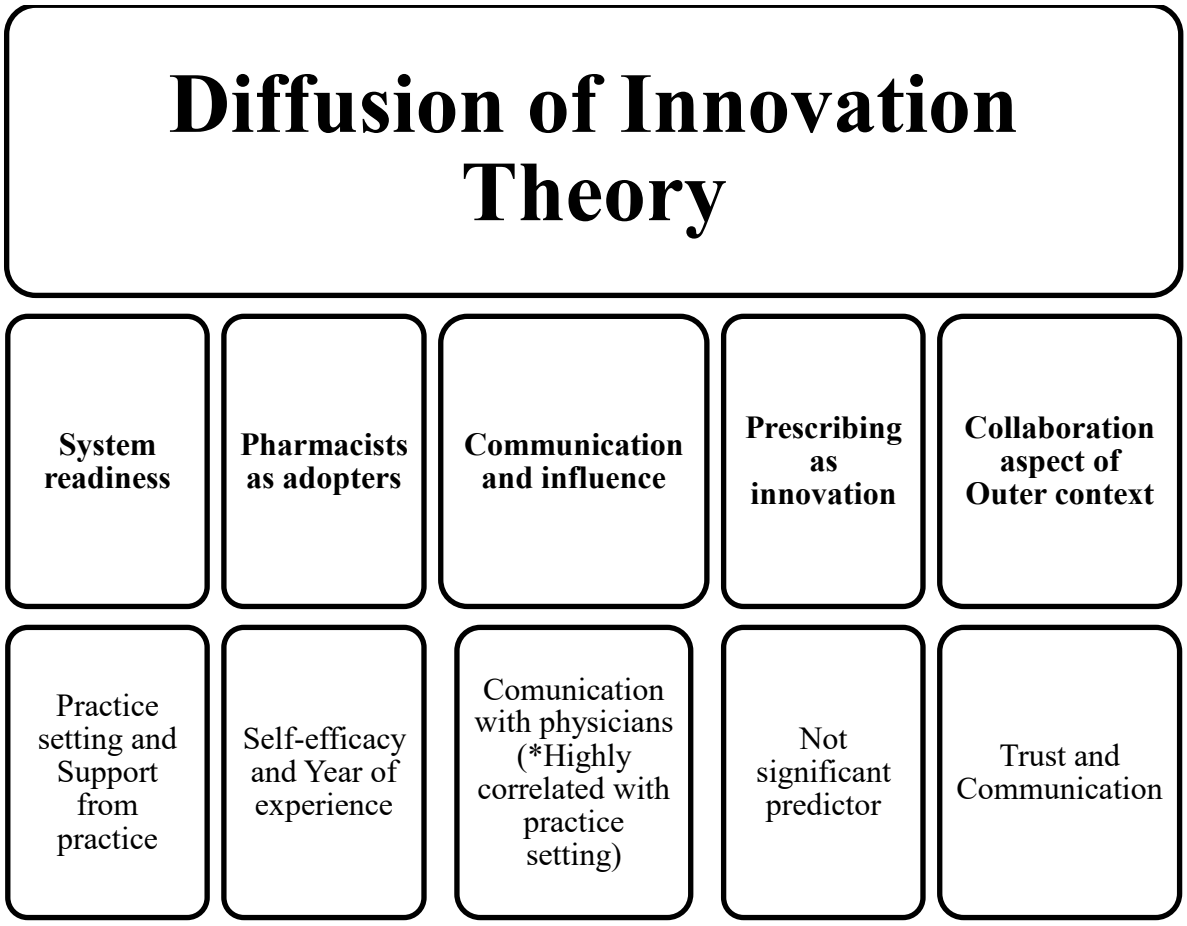

Figure 7.1 Factors affecting pharmacist prescribing adoption in Alberta according our conceptual model

Bibliography

A Guide to Good Prescribing Practice for Prescribing Pharmacists in Scotland- NHS Education for Scotland. [Updated 2012 Jul; cited 2017 Jun 15]. Available from: http://www.nes.scot.nhs.uk/media/1457463/nesd0061_goodprescribingpractice.pdf

Addison B, Weidmann A, Diane Harpell D, et al. Pharmacist prescribing education: An international knowledge exchange study. *Can Pharm J (Ott).* 2014;147(4):S42

Aerde JV. Physician leadership development, Alberta Health service. 2013

Al Hamarneh Y, Tsuyuki R, Hemmelgarn B, Jones C, Oladele D. The design of the Alberta Vascular Risk Reduction Community Pharmacy Project: RxEACH. *Can Pharm J (Ott).* 2014;147(4):S46

Al Hamarneh YN, Charrois T, Lewanczuk R, Tsuyuki RT. Pharmacist intervention for glycemic control in the community (the RxING study). *BMJ* Open. 2013;3:e003154

Al HamarnehY, Sauriol L, Tsuyuki R. Economic analysis of the RxING study. *Can Pharm J (Ott).* 2014;147(4):S47

Alberta College of Pharmacists Annual Report 2015-2016. [Updated 2016 Feb; cited 2017 Feb 23]. Available from: https://pharmacists.ab.ca/articles/2015-2016-annual-report-now-available

Alberta Pharmacists' Prescribing Practices (PIN Data) 2015

Altschuler J, Margolius D, Bodenheimer T, Grumbach K. Estimating a Reasonable Patient Panel Size for Primary Care Physicians With Team Based Task Delegation. *Ann Fam Med*. 2012;10:396-400

American Society of Health System Pharmacists. List of States by Statutory and Regulatory Authority. 2006.

Arksey H, O'Malley L. Scoping Studies: Towards a Methodological Framework. *Int J Social Research Methodology.* 2005;8(1):19-32.

Austin Z, Ensom MHH. Education of Pharmacists in Canada. *Am J Pharm Educ*. 2008; 72(6): 128.

Auta A, Strickland-Hodge B, Maz J, Alldred DP. Pharmacist prescribing in the United Kingdom and the implication for the Nigerian context. *West Afr J Pharm*. 2015;26(1):54-61.

Bandura A. Self-efficacy. In V. S. Ramachaudran (Ed.), Encyclopedia of human behavior (Vol. 4, pp. 71-81). New York: Academic Press. 1994.

Bandura A. Self-efficacy: The exercise of control. New York: W.H. Freeman.1997

Bardet JD, Vo TH, Bedouch P, Allenet B. Physicians and community pharmacists collaboration in primary care: A review of specific models. *Res Social Adm Pharm*. 2015;11(5):602-22.

Becoming the Best: Alberta's 5-Year Health Action Plan 2010

Berwick DM. Disseminating innovations in health care. *JAMA*. 2003;289(15):1969-75.

Biddle B. Recent developments in role theory. *Annu Revi Sociol.* 1986; 12(1): 67-92.

Bishop AC, Boyle TA, Morrison B, Barker JR, Zwicker B, Mahaffey T, et al. Public perceptions of pharmacist expanded scope of practice services in Nova Scotia. *Can Pharm J (Ott).* 2015; 148(5):274-83

Bland JM, Altman D,G. Statistics notes: Cronbach's alpha. *Br Med J.* 1997;314(7080):572.

Blenkinsopp A, Tann J, Evans A, Grime J. Opportunity or threat? General practitioner perceptions of pharmacist prescribing. *Int J Pham Pract.* 2008;16(1):29-34.

Boon H, Verhoef M, O'Hara D, Findlay B. From parallel practice to integrative health

care: a conceptual framework. *BMC health*. 2004;4(1):15.

Bourne RS, Baqir W, Onatade R. Pharmacist independent prescribing in secondary care: opportunities and challenges. *Int J Clin Pharm.* 2016;38:1–6

Bourne RS, Whiting P, Brown LS, Borthwick M. Pharmacist independent prescribing in critical care: results of a national questionnaire to establish the 2014 UK position. *Int J Pharm Pract*. 2016;24(2):104-13.

Bradley F, Ashcroft DM, Noyce PR. Integration and differentiation: a conceptual model of general practitioner and community pharmacist collaboration. *Res Social Adm Pharm*. 2012 Feb;8(1):36-46.

Britain G, Cumberlege J. Neighbourhood Nursing: a focus for care. HM Stationery Office; 1986.

Burke M, Hodgins M. Is 'dear colleague' enough? improving response rates in surveys of healthcare professionals. *Nurse Res.* 2015;23(1):8.

Cain M, Mittman R. Diffusion of innovation in health care. 2002

Canadian Collaborative Centre for Physician Resources. Canadian Physician Resources – 2017 Basic Facts. Canadian Medical Association; 2017. [Updated 2017 March; cited 2017 May 20]. Available from: https://www.cma.ca/En/Pages/basic-physician-facts.aspx

Canadian Pharmacists Association. Environmental Scan: Pharmacy Practice Legislation and Policy Changes across Canada 2014; [Updated 2014; cited 2017 May 20]. Available from: http://blueprintforpharmacy.ca/docs/resource-items/scope-of-practice---september-2014.pdf.

Chadi N. Medical Leadership: Doctors at the Helm of Change. *MJM*. 2009; 12(1):52-57

Charrois TL, McAlister FA, Cooney D, Lewanczuk R, Kolber MR, Campbell NR, et al. Improving hypertension management through pharmacist prescribing; The rural Alberta

clinical trial in optimizing hypertension (Rural RxACTION): Trial design and methods. *Implement Sci.* 2011;6(1):94.

Charrois TL, Rosenthal M, Hoti K, Hughes C. Pharmacy Student Perceptions of Pharmacist Prescribing: A Comparison Study. *Pharmacy.* 2013;1(2):237-247.

Charrois TL, Rosenthal M, Tsuyuki RT. Stories from the trenches: Experiences of Alberta pharmacists in obtaining additional prescribing authority. *Can Pharm J (Ott).* 2012;145(1):30-34.

Chen G, Casper WJ, Cortina JM. The Roles of Self-Efficacy and Task Complexity in the Relationships Among Cognitive Ability, Conscientiousness, and Work-Related Performance: A Meta-Analytic Examination. *Hum Perform.* 2001; 14(3): 209-230

Child D, Cantrill JA. Hospital doctors' perceived barriers to pharmacist prescribing. *Int J Pham Pract.*1999;7:230-7

Cook JV, Dickinson HO, Eccles MP. Response rates in postal surveys of healthcare professionals between 1996 and 2005: An observational study. *BMC Health Serv Res.* 2009;9(1):160.

Cooper RJ, Anderson C, Avery T, Bissell P, Guillaume L, Hutchinson A, et al. Nurse and pharmacist supplementary prescribing in the UK--a thematic review of the literature. *Health Policy.* 2008;85(3):277-292.

Cooper RJ, Bissell P, Ward P, Murphy E, Anderson C, Avery T, et al. Further challenges to medical dominance? The case of nurse and pharmacist supplementary prescribing. *Health:.* 2012;16(2):115-33.

Cooper RJ, Guillaume L, Avery T, Anderson C, Bissell P, Hutchinson A, et al. Nonmedical prescribing in the United kingdom: developments and stakeholder interests. *J*

Ambulatory Care Manage. 2008;31(3):244-52.

Cope LC, Abuzour AS, Tully MP. Nonmedical prescribing: where are we now? *Ther Adv Drug Saf.* 2016;7(4):165–172

Cor MK. Trust me, it is valid: Research validity in pharmacy education research, *Curr Pharm Teach Learn* 2016; 8 (3): 391-400

Cramm JM, Nieboer AP. Relational coordination promotes quality of chronic care delivery in Dutch disease-management programs. *Health Care Manage Rev.* 2012; 37(4): 301-309

Department of Health, the United Kingdom. Improving patients' access to Medicines: A guide to implementing Nurse and Pharmacists Independent Prescribing within the NHS in England. 2006 Apr; Gateway reference: 6429.

Dillman DA, Christian LM, Smyth JD. Internet, mail, and mixed-mode surveys. 3rd ed. Hoboken, NJ: Wiley; 2009:15.

Donald M, King-Shier K, Tsuyuki RT, Al Hamarneh YN, Jones CA, Manns B, et al. Patient, family physician and community pharmacist perspectives on expanded pharmacy scope of practice: a qualitative study, *CMAJ Open.* 2017;5(1),E205-E212

Drysdale JS, Graham CR, Spring KJ, Halverson LR. An analysis of research trends in dissertations and theses studying blended learning. *Internet High Educ.* 2013;17(0):90-100.

Emmerton L, Marriott J, Bessell T, Nissen L, Dean L. Pharmacists and prescribing rights: Review of international developments. *J Pharm Pharm Sci* 2005;8(2):217-225.

Erlandson DA, Harris EL, Skipper B L, Allen S D. *Doing naturalistic enquiry: A guide to methods.* Newbury Park, CA: Sage. 1993

Faruquee CF, Cor K, Hughes CA, Makowsky M, Sadowski C, Schindel T, et al.

Characterizing pharmacist prescribers in Alberta using cluster analysis (Under review, Chapter four)

Faruquee CF, Guirguis LM. A scoping review of research on the prescribing practice of Canadian pharmacists. *Can Pharm J (Ott).* 2015;148(6):325-48.

Fisher J, Kinnear M, Reid F, Souter C, Stewart D. What supports hospital pharmacist prescribing in Scotland? – A mixed methods, exploratory sequential study. *Res Social Adm Pharm.* 2017 Jun; 10.1016/j.sapharm.2017.06.007

Frankel GEC, Austin Z. Responsibility and confidence: Identifying barriers to advanced pharmacy practice. *Can Pharm J (Ott).* 2013;146:155-161.

Gagnon-Arpin I, Dobrescu A, Sutherland G, Stonebridge C, Dinh T. The Value of Expanded Pharmacy Services in Canada. Ottawa: The Conference Board of Canada, 2017

Gebhart F. Drug Topics. California gives prescribing clout over controlled substances. 2004; [Updated 2004 Dec 13; cited 2017 May 20]. Available from: http://drugtopics.modernmedicine.com/drug-topics/news/california-gives-pharmacists-prescribing-clout-over-controlled-substances.

George J, McCaig DJ, Bond CM, Cunningham IT, Diack HL, Watson AM, et al. Supplementary prescribing: Early experiences of pharmacists in Great Britain. *Ann Pharmacother*. 2006;40(10):1843-50.

George J, Pfleger D, McCaig D, Bond C, Stewart D. Independent prescribing by pharmacists: a study of the awareness, views and attitudes of Scottish community pharmacists. *Pharm World Sci.* 2006;28(2):45-53.

Gerard K, Tinelli M, Latter S, Blenkinsopp A, Smith A. Valuing the extended role of prescribing pharmacist in general practice: results from a discrete choice experiment. *Value*

Health. 2012;15(5):699-707.

Gittell JH, Fairfield KM, Bierbaum B, Head W, Jackson R, Kelly M, et al. Impact of Relational Coordination on Quality of Care, Postoperative Pain and Functioning, and Length of Stay: A Nine-Hospital Study of Surgical Patients. *Med Car.* 2000; 38(8):807-819

Gittell JH. Relational Coordination: Guidelines for Theory, Measurement and Analysis, Revised: August 25, 2011. [Updated 2011; cited 2017 Jun 20]. Available from: (http://rcrc.brandeis.edu/downloads/Relational_Coordination_Guidelines_8-25-11.pdf)

Gittell JH. Relationships between service providers and their impact on customers. *J Serv Res*. 2002; 4(4):299-311.

Glanz K, Rimer BK, Viswanath K. *Health Behavior and Health Education: Theory, Research, and Practice*.4th ed. San Francisco, CA: Jossey-Bass; 2008.

Granovetter M, Soong R. Threshold models of diffusion and collective behavior. *J Math Sociol.* 1983;9(3):165-79.

Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: Systematic review and recommendations. *Milbank Q*. 2004;82(4):581-629.

Grindrod KA, Lynd LD, Joshi P, Rosenthal M, Isakovic A, Marra CA. Pharmacy Owner and Manager Perceptions of Pharmacy Adaptation Services in British Columbia. *Can Pharm J (Ott).* 2011;144(5):231-235.

Guide to receiving Additional Prescribing Authorization, Alberta College of Pharmacists, 2nd Edition. [Updated 2013 Jan; cited 2017 May 25]. Available from: https://pharmacists.ab.ca/sites/default/files/APAGuide.pdf

Guidelines for Minor Ailment Prescribing, University of Saskachewan. [Updated 2017

May 01; cited 2017 May 25]. Available from: https://medsask.usask.ca/professional/guidelines/

Guirguis L, Dolovich L, Hughes C, Makowsky MJ, Sadowski CA, Schindel TJ, et al. Pharmacists' perceptions of prescribing in two Canadian jurisdictions. *Can Pharm J (Ott).* 2014;147(4):S21

Guirguis LM, Chewning BA, Kieser MA. Predictors of Pharmacy Students' Intentions to Monitor Diabetes. *J Pharm Pharmaceut Sci.* 2009; 12(1):33 – 45.

Guirguis LM, Cooney D, Dolovich L, Eberhart G, Hughes C, Makowsky M, et al. Exploring pharmacists' understanding and adoption of prescribing in 2 Canadian jurisdictions: Design and rationale for a mixed-methods approach. *Can Pharm J (Ott).* 2011; 144(5):240-244.

Guirguis LM, Hughes CA, Makowsky M, Sadowski C, Schindel T, Yuksel N. Development of a Survey to Explore Pharmacists Prescribing Practices (Under review, Chapter three)

Guirguis LM, Hughes CA, Makowsky MJ. Sadowski CA, Schindel TJ, Yuksel N. Survey of pharmacist prescribing practices in Alberta. *Am J Health Syst Pharm*. 2017;74(2):62-69.

Guirguis LM, Hughes CA, Mark Makowsky M, Sadowski CA, Schindel TJ, Yuksel N. Pharmacists' prescribing practices in Alberta: Report of a provincial survey. *Can Pharm J (Ott).* 2014;147(4):S6

Guirguis LM, Makowsky MJ, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N. How have pharmacists in different practice settings integrated prescribing privileges into practice in Alberta? A qualitative exploration. *J Clin Pharm Ther.* 2014; 39(4): 390-98.

Guntern S, Korpershoek H & Werf GV. Benefits of personality characteristics and self-efficacy in the perceived academic achievement of medical students. *J. Educ. Psychol.* 2017; 37:6, 733-744

Gustafson DH, Sainfort F, Eichler M, Adams L, Bisognano M, Steudel H. Developing and testing a model to predict outcomes of organizational change. *Health Serv Res.* 2003;38(2):751-76.

Hager K, Uden D, Tomaszwski D. Bridging the location gap: How can pharmacists and physicians collaborate to provide patient care. *J Res Interprof Pract Educ*. 2015;5(2):1-14.

Hall J, Rosenthal M, Family H, Sutton J, Hall K, Tsuyuki RT. Personality traits of hospital pharmacists: toward a better understanding of factors influencing pharmacy practice change. *Can J Hosp Pharm.* 2013;66(5):289-295.

Hammond RW, Schwartz AH, Campbell MJ, Remington TL, Chuck S, Blair MM, et al. Collaborative Drug Therapy Management by Pharmacists. *Pharmacotherapy* 2003;23(9):1210-1225

Hatah, E, Braund, R, Duffull, SB, Tordoff; J. General practitioners' views of pharmacists' current and potential contributions to medication review and prescribing in New Zealand. *J Prim Health Care* .2013;5(3):223–233

Health System Efficiency in Canada: Why Does Efficiency Vary Among Regions? Canadian Institute for Health Information 2014

Healthcare Governance Models in Canada, Pre-Summit Discussion Paper, March 2013

Heck T, Gunther M, Bresee L, Mysak T, Mcmillan C, Koshman S. Independent prescribing by hospital pharmacists: Patterns and practices in a Canadian province. *Am J Health Syst Pharm.* 2015; 72 (24): 2166-2175

Henrich N, Joshi P, Grindrod KA, Lynd LD, Marra CA. Family Physicians' Perceptions of Pharmacy Adaptation Services in British Columbia. *Can Pharm J* (Ott). 2011; 144(4):172-178.

Hill JD, Hill JM, Gentile NJ. A review of state pharmacist collaborative practice laws. *Am J Health Syst Pharm*. 2016 73(18):1467-1472.

Hoti K, Hughes J, Sunderland B. An expanded prescribing role for pharmacists - an Australian perspective. *Australas Med J.* 2011;4(4):236-242.

Hoti K, Sunderland B, Hughes J, Parsons R. An evaluation of Australian pharmacist's attitudes on expanding their prescribing role. Pharm World Sci. 2010; 32:610–621

Houle SK, Charrois TL, McAlister FA, Kolber MR, Rosenthal MM, Lewanczuk R, et al. Pay-for-performance remuneration for pharmacist prescribers' management of hypertension: A substudy of the RxACTION trial. *Can Pharm J (Ott)*. 2016;149(6):345-51.

Hughes CA, Guirguis LM, Wong T, Ng K, Ing L, Fisher K. Influence of pharmacy practice on community pharmacists' integration of medication and lab value information from electronic health records. *J Am Pharm Assoc*. 2011;51(5):591-598.

Hughes CA, Makowsky M, Sadowski CA, Schindel TJ, Yuksel N, Guirguis LM. What prescribing means to pharmacists: a qualitative exploration of practising pharmacists in Alberta. *Int J Pharm Pract.* 2014; 22(4):283-291.

Hughes CM, McCann S. Perceived interprofessional barriers between community pharmacists and general practitioners: a qualitative assessment. *Br J Gen Pract.* 2003;53(493):600-606.

Hunt MR. Strengths and challenges in the use of interpretive description: reflections arising from a study of the moral experience of health professionals in humanitarian work.

QHR. 2009; 19(9): 1284-1292.

Hutchison M, Lindblad A, Guirguis LM, Cooney D, Rodway M. Survey of Alberta hospital pharmacists' perspectives on additional prescribing authorization. *Am J Health-Syst Pharm.* 2012; 69(22):1983-1992.

Hwang S, Koleba T, Mabasa VH. Assessing the Impact of an Expanded Scope of Practice for Pharmacists at a Community Hospital. *Can J Hosp Pharm*. 2013 Sep-Oct; 66(5): 304–309.

Jain R, Roy Dobson D. Preliminary findings of a study of experience with prescriptive authority (PA) services among Saskatchewan community pharmacists. *Can Pharm J (Ott).* 2014;147:S49.

Kaplan SH, Greenfield Sm Gandek B, Rogers WH, Ware JE Jr. Characteristics of physicians with participatory decision-making styles. *Ann Intern Med*. 1996;124:497-504

Kelly DV, Bishop L, Young S, Hawboldt J, Phillips L, Keoug TM. Pharmacist and physician views on collaborative practice: Findings from the community pharmaceutical care project. *Can Pharm J (Ott).* 2013; 146(4):218-26.

Kelly DV, Young S, Phillips L, Clark D. Patient attitudes regarding the role of the pharmacist and interest in expanded pharmacist services. *Can Pharm J (Ott).* 2014;147(4):239-47.

Khalid MN. Cluster analysis-a standard setting technique in measurement and testing. *JAQM*. 2011;6(2).

Latter S, Blenkinsopp A. Non-medical prescribing: current and future contribution of pharmacists and nurses. *Int J Pharm Pract.* 2011; 19:381-2

Latter S, Maben J, Myall M, Young A. Evaluating nurse prescribers' education and continuing professional development for independent prescribing practice: Findings from a

national survey in england. *Nurse Educ Today*. 2007;27(7):685-696.

Law MR, Cheng L, Kratzer J, Morgan, Marra C, Lynd LD,et al. Impact of allowing pharmacists to independently renew prescriptions: A population-based study. *J Am Pharm Assoc.* 2015;55(4):398–404.

Law MR, Ma T, Fisher J, Sketris IS. Independent pharmacist prescribing in Canada. *Can Pharm J (Ott).* 2012;145(1):17-23.

Law MR, Morgan SG, Majumdar SR, Lynd LD, Marra CA. Effects of prescription adaptation by pharmacists. *BMC Health Serv Res.* 2010;10(1):313.

Lim RHM, Courtenay M, Fleming G. Roles of the non-medical prescribing leads within organisations across a strategic health authority: Perceived functions and factors supporting the role. *Int J Pharm Pract*. 2013;21(2):82-91.

Lin CT, Albertson GA, Schilling LM, Cyran EM, Anderson AN, Ware L, et al. Is patients' perception of time spent with the physician a determinant of ambulatory patient satisfaction? *Arch Intern Med.* 2001;161:1437-1442

Lincoln YS, Guba EG *Naturalistic inquiry*. Beverly Hills, CA: Sage. 1985

Liu Y, Doucette WR, Farris KB. Examining the development of pharmacist-physician collaboration over 3 months. *Res Social Adm Pharm*. 2010;6(4):324-33.

Liu Y, Doucette WR. Exploring stages of pharmacist–physician collaboration using the model of collaborative working relationship. *J Am Pharm Assoc (2003).* 2011 Jun 30;51(3):412-9a.

Lloyd F, Hughes CM. Pharmacists' and mentors' views on the introduction of pharmacist supplementary prescribing: a qualitative evaluation of views and context. *Int J Pham Pract.* 2007;15(1):31-37

Lloyd F, Parsons C, Hughes CM. 'It's showed me the skills that he has': Pharmacists' and mentors' views on pharmacist supplementary prescribing. *Int J Pharm Pract.* 2010;18(1):29-36.

Lunenbarg FC. Self-Efficacy in the Workplace: Implications for Motivation and Performance. *IJMBA*. 2011; 14 (1) [Updated 2011 Dec; cited 2017 May 15]. Available from: http://www.nationalforum.com/Electronic%20Journal%20Volumes/Lunenburg,%20Fred%20C.%20Self-Efficacy%20in%20the%20Workplace%20IJMBA%20V14%20N1%202011.pdf

Lyster RL, Houle SK. Abnormal vaginal bleeding following pharmacist prescribing of metformin leads to the detection of complex endometrial hyperplasia. *Ann Pharmacother.* 2013; 47(11):1581-1583.

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.

Maddox C, Halsall D, Hall J, Tully MP. Factors influencing nurse and pharmacist willingness to take or not take responsibility for non-medical prescribing. *Res Social Adm Pharm*. 2016;12(1):41-55.

Makowsky MJ, Guirguis LM, Hughes CA, Sadowski CA, Schindel TJ, Yuksel N**.** Factors influencing pharmacists' adoption of prescribing: qualitative application of the diffusion of innovations theory. *Implement Sci.* 2013; 8(1):109

Manca DP, Varnhagen S, Brett-MacLean P, Allan GM, Szafran O, Ausford O, et al. Rewards and challenges of family practice. *Can Fam Physician.* 2007; 53(2):277-286;

Mansell K, Bootsman N, Kuntz A, Taylor J. Evaluating pharmacist prescribing for minor ailments. *Int J Pharm Pract.* 2015; 23(2):95-101

Marra CA, Lynd LD, Grindrod KA, Joshi P, Isakovic A. Evaluating the labour costs

associated with pharmacy adaptation services in British Columbia. *Can Pharm J (Ott).* 2012;145(2):78-82.

Martin BA, Bruskiewitz RH, Chewning BA. Effect of a tobacco cessation continuing professional education program on pharmacists' confidence, skills, and practice-change behaviors. *J AmPharm Assoc.* 2010;50(1):18a.

Mawardi BH. Satisfactions, dissatisfactions, and causes of stress in medical practice. *JAMA.* 1979;241(14):1483-6.

McAlister FA, Majumdar SR, Padwal RS, Fradette M, Thompson A, Buck B, et al. Case management for blood pressure and lipid level control after minor stroke: PREVENTION randomized controlled trial. *CMAJ*. 2014;186(8):577-84.

McBane SE, Dopp Al, Abe A, Benavides S, Chester EA, Dixon DL, et al. Collaborative Drug Therapy Management and Comprehensive Medication Management. *Pharmacotherapy* 2015;35(4):e39–e50

McCann LM, Haughey SL, Parsons C, Lloyd F, Crealey G, Gormley GJ, et al. A patient perspective of pharmacist prescribing: 'crossing the specialisms-crossing the illnesses'. *Health Expect.* 2015; 18(1):58-68.

McDonough R, Doucette W. Developing collaborative working relationships between pharmacists and physicians. *J Am Pharm Assoc.* 2001;41(5):682-92.

McKinnon A, Jorgenson D. Pharmacist and physician collaborative prescribing: For medication renewals within a primary health centre. *Can Fam Phys.* 2009;55(12):e86-e91.

Merriam S. *Case study research in education: A qualitative approach*. San Francisco: Jossey-Bass Edition 1. 1988.

Mertens DM. Research methods in education and psychology: *Integrating diversity with quantitative and qualitative approaches.* Thousand Oaks, CA: Sage 1998

National Health Expenditure Trends, 1975 to 2014. National Health Expenditure Database, Canadian Institute for Health Information. [Updated 2014; cited 2017 May 20]. Available from: https://www.cihi.ca/en/nhex_2014_report_en.pdf

National Health Expenditure Trends, 1975 to 2016 (report 2016)

Neubauer SL, Suveges LG, Phillips KA, Kolodziejak LR. Competency assessment of pharmacists providing emergency contraception. *Can Pharm J (Ott).* 2004;137(2):28-33.

Norman WV, Soon JA, Panagiotoglou D, Albert A, Zed PJ. The acceptability of contraception task-sharing among pharmacists in Canada — the ACT-Pharm study. *Contraception.* 2015 Jul. 92:55–61.

Norman WV, Wong M, Soon J, Zed P. DO rural pharmacists in British Columbia find independent prescribing of hormonal contraceptives feasible and acceptable? The "act-pharm" study. *Contraception.* 2013;88(3):451-452.

OECD (Organization for Economic Co-operation and Development) Health Statistics 2014. [Updated 2014 November; cited 2017 May 20]. Available from: http://www.oecd.org/els/health-systems/oecd-health-statistics-2014-frequently-requested-data.htm

Ostbye T, Yarnall KSH, Krause KM, Pollak KI, Gradison M, Michener JL. Is there time for management of patients with chronic diseases in primary care? *Ann Fam Med*. 2005;3(3):209-214.

Patel T, Chang F, Mohammed HT, Raman-Wilms L, Jurcic J, Khan A, et al. Knowledge,

perceptions and attitudes toward chronic pain and its management: A cross-sectional survey of frontline pharmacists in Ontario, Canada. *PLoS One*. 2016;11(6):e0157151.

Paudyal V, Hansford D, Cunningham S, Stewart D. Over-the-counter prescribing and pharmacists' adoption of new medicines: Diffusion of innovations. *Res Social Adm Pharm* 2013; 9: 251–262.

Perepelkin J. Public opinion of pharmacists and pharmacist prescribing. *Can Pharm J (Ott).* 2011;144(2):86-93.

Pharmacist Prescriber Scope of Practice, Pharmacy Council of New Zealand 2013. [updated 2013 April; cited 2017 May 20]. Available from: http://www.pharmacycouncil.org.nz/Portals/12/Documents/prescribers/NZ%20Pharmacist%20Prescriber%20Scope%20of%20Practice%20FINAL.pdf?ver=2017-02-20-125642-553

Pharmacists' Expanded Scope of Practice in Canada, Canadian Pharmacists Association. [Updated 2016 Dec; cited 2017 Feb 23]. Available from: http://www.pharmacists.ca/index.cfm/pharmacy-in-canada/scope-of-practice-canada/

Pit SW, Vo T, Pyakurel S. The effectiveness of recruitment strategies on general practitioner's survey response rates - a systematic review. *BMC Med Res Methodol*. 2014;14(1):76.

Pojskic N, MacKeigan L, Boon H, Austin Z. Initial perceptions of key stakeholders in Ontario regarding independent prescriptive authority for pharmacists. *Res Social Adm Pharm.* 2014; 10(2):341-354.

Position Statement on Pharmacist Prescribing, Canadian Pharmacists Association. [Updated 2011 Oct; cited 2017 May 27]. Available from: http://www.pharmacists.ca/cpha-ca/assets/File/cpha-on-the-issues/PPPharmacistPrescribing.pdf

Pronk MCM, Blom ATG, Jonkers R, Rogers EM, Bakker A, de Blaey KJ. Patient oriented activities in Dutch community pharmacy: Diffusion of innovations. *Pharm World Sci*. 2002;24(4):154-161.

Rogers EM. Diffusion of Innovations: 4th ed. New York: The Free Press; 2003.

Rogers EM. Diffusion of Innovations: Fourth ed. New York: The Free Press; 1995.

Rosenthal M, Ross Tsuyuki R, A community-based approach to dyslipidemia management: Pharmacist prescribing to achieve cholesterol targets (RxACT Study). *Can Pharm J (Ott)*. 2014;147(4):S20

Rosenthal M, Tsuyuki RT. Does personality explain research performance?. *Can Pharm J (Ott).* 2012;145(4):S24.

Rosenthal MM, Breault RR, Austin Z, Tsuyuki RT. Pharmacists' self-perception of their professional role: insights into community pharmacy culture. *J Am Pharm Assoc (2003).* 2011;51(3):363-8a.

Rosenthal MM, Houle SK, Eberhart G, Tsuyuki RT. Prescribing by pharmacists in Alberta and its relation to culture and personality traits. *Res Social Adm Pharm.* 2015;11(3):401-11

Rubio-Valera M, Jové AM, Hughes CM, Guillen-Solà M, Rovira M, Fernández A. Factors affecting collaboration between general practitioners and community pharmacists: a qualitative study. *BMC Health.* 2012; 12(1):188

Saba M, Diep J, Bittoun R, Saini B. Provision of smoking cessation services in Australian community pharmacies: a simulated patient study. *Int J Clin Pharm.* 2014, 36:604–614

Schindel TJ, Given L. CAIS Paper: 'Collaboration' is the New Black: Independent Pharmacist Prescribing in a Collaborative Environment. In Proceedings of the Annual

Conference of CAIS/Actes du congrès annuel de l'ACSI 2016 Jun 21.

Schindel TJ, Given LM. The pharmacist as prescriber: A discourse analysis of newspaper media in Canada. *Res Social Adm Pharm* 2013;9(4):384-395.

Schindel TJ, Yuksel N, Breault R, Daniels J, Varnhagen S, Hughes CA. Perceptions of pharmacists' roles in the era of expanding scopes of practice. *Res Social Adm Pharm.* 2017; 13(1): 148–161.

Selim SZ, Ismail MA. K-means-type algorithms: A generalized convergence theorem and characterization of local optimality. *IEEE Trans Pattern Anal Mach Intell.* 1984;(1):81-7.

Sketris I. Extending prescribing privileges in Canada. *Can Pharm J.* 2009 Jan;142(1):17-19.

Snyder ME, Zillich AJ, Primack BA, Rice KR, McGivney MA, Pringle JL, Smith RB. Exploring successful community pharmacist-physician collaborative working relationships using mixed methods. *Res Social Adm Pharm*. 2010;6(4):307-23.

Soon J, Leung V, Smith A, Shoveller J. Temporal and regional differences in emergency contraception use: A population-based analysis. *Contraception.* 2011;84(3):327.

Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int J Pham Pract.* 2009; 17(2): 89-94.

Stewart DC, George J, Bond CM, Diack HL, McCaig DJ, Cunningham S. Views of pharmacist prescribers, doctors and patients on pharmacist prescribing implementation. *Int J Pharm Pract*. 2009;17(2):89-94.

Sullivan GM, Artino Jr AR. Analyzing and interpreting data from Likert-type

scales.Journal of graduate medical education. 2013;5(4):541-2.

Svarstad BL, Bultman DC, Mount JK. Patient Counseling Provided in Community Pharmacies: Effects of State Regulation, Pharmacist Age, and Busyness. *J Am Pharm Assoc.* 2004;44:22–29.

Tabachnick BG, Fidell LS. Using multivariate statistics. 5th ed. Boston: Pearson/Allyn and Bacon; 2007:646.

Tamblyn R, Berkson L, Dauphinee WD, Gayton D, Grad R, Huang A, et al. Unnecessary prescribing of NSAIDs and the management of NSAID-related gastropathy in medical practice. *Ann Intern Med*. 1997;127(6):429-38.

Tann J, Blenkinsopp A, Grime J, Evans A. The great boundary crossing: Perceptions on training pharmacists as supplementary prescribers in the UK. *Health Educ J.* 2010;69(2):183-191.

Terner M, Reason B, McKeag AM, Tipper B, Webster G. Chronic conditions more than age drive health system use in Canadian seniors. *Healthc Q.* 2011; 14(3):19-22.

The health professional's guide to pharmacist prescribing: Alberta College of Pharmacists. [Updated 2012 Sep; cited 2017 Jun 17]. Available from: https://pharmacists.ab.ca/sites/default/files/HPGuidePrescribing.pdf

Thorne S, Kirkham SR, MacDonald-Emes J. Focus on Qualitative Methods Interpretive Description: A Noncategorical Qualitative Alternative for Developing Nursing Knowledge. *Res Nurs Health*. 1997; 20(2):169–177.

Thorne SE. Interpretive description. Walnut Creek, CA: Left Coast Press; 2008

Thorne S, Data analysis in qualitative research, *Evidence-Based Nursing* 2000;3:68-70.

Tonna AP, Edwards RM. Is there a place for qualitative research methods in pharmacy

practice? *Eur J Hosp Pharm Sci Pract.* 2012;20(2):97-99.

Tonna AP, Stewart D, McCaig D. An international overview of some pharmacist prescribing models. *J Malta College Pharm Pract.* 2008;(14):20-26.

Tonna AP, Stewart D, West B, McCaig D. Pharmacist prescribing in the UK - a literature review of current practice and research. *J Clin Pharm Ther.* 2007;32(6):545-556.

Tsao NW, Lynd LD, Gastonguay L, Li K1, Nakagawa B1, Marra CA. Factors associated with pharmacists' perceptions of their working conditions and safety and effectiveness of patient care. *Can Pharm J (Ott).* 2016;149(1):18-27.

Tsuyuki RT, Houle SKD, Charrois TL, Kolber MR, Rosenthal MM, Lewanczuk R, et al. A 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

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):283-92.

Ukens C. Florida VA pharmacists pioneer independent prescribing. *Hosp Pharm*. 1997; (11):33.

Valente TW. Social network thresholds in the diffusion of innovations. *Soc. Networks*. 1996;18(1):69-89.

Wait Times Database, 2013, CIHI; OECD Health Data 2015

Warchal S, Brown D, Tomlin M, Portlock J. Attitudes of successful candidates of supplementary prescribing courses to their training and their extended roles. *Pharm. J.* 2006; 276.

Weiss MC, Platt J, Riley R, Horrocks S. GPs, nurses and pharmacists as prescribers in primary care: an exploration using the social identity approach. *IJHP*. 2016;3(2):153-64.

Weiss MC, Sutton J. The changing nature of prescribing: pharmacists as prescribers and challenges to medical dominance. *Sociol Health Ill.* 2009;31(3):406-21.

Weissenborn M, Haefeli WE, Peters-Klimm F, Seidling HM. Interprofessional communication between community pharmacists and general practitioners: a qualitative study. *Int J Clin Pharm.* 2017;3(39):495-506.

West R, Isom M. Management of patients with hypertension: general practice and community pharmacy working together, *Br J Gen Pract.* 2014; 64(626): 477–478.

Westrick SC, Mount JK. Impact of perceived innovation characteristics on adoption of pharmacy-based in-house immunization services. *Int J Pharm Pract*. 2009;17(1):39-46.

Wong M, Soon JA, Zed PJ, Norman WV. Development of a Survey to Assess the Acceptability of an Innovative Contraception Practice among Rural Pharmacists. *Pharmacy.* 2014;*2*:124-136

Woolfrey S, Dean C, Hall H, Hospital pharmacist prescribing: a pilot study. Pharm J. 2000; 265 (7105):97-99

Yarnall KSH, Østbye T, Krause KM, Pollak KI, Gradison M, Michener JL. Family physicians as team leaders: "time" to share the care. *Prev Chronic Dis*. 2009 ;6(2):A59-A64.

Yarnall KSH, Pollak KI, Østbye T, Krause KM, Michener JL. Primary care: is there enough time for prevention? *Am J Public Health*. 2003; 93(4):635-641.

Yorra ML. Self-efficacy and self-esteem in third-year pharmacy students. *Am Journal Pharm Edu*. 2014;78(7):134.

Yuksel N, Eberhart G, Bungard TJ. Prescribing by pharmacists in Alberta. *Am J Health*

Syst Pharm. 2008;65(22):2126-32.

Yuksel N, Hughes CA, Schindel TJ, Daniels J, Varnhagen S. Pharmacists' self-described professional role: A shift in emphasis. *Can Pharm J (Ott)*. 2015;148(4):S2.

Appendices

Appendix 1: Search strategy in MEDLINE database for the scoping review (Chapter 2)

Pharmacist Prescribing

(1) (pharmacist* adj2 (prescribe or prescribes or prescribing)).mp.

(2) Pharmacists/ or pharmacist$.mp.

(3) Drug Prescriptions/ and prescrib$.ti,ab.

(4) ((independent* or supplementary or nonmedical or non-medical or repeat) adj2 prescrib*).mp.

(5) (Prescribing by protocol or protocol-based prescribing).mp.

(6) Patient Group directions.mp.

(7) (Prescribing by formulary or formulary-based prescribing or formulary-guided prescribing).mp.

(8) Collaborative prescribing.mp.

(9) ((prescribing or prescribe or prescriptive) adj2 (authori* or power* or privilege* or right*)).mp.

(10) 3 or 4 or 5 or 6 or 7 or 8 or 9

(11) 2 and 10

(12) 1 or 11

Pharmacist Prescribing in Canada

(13) expcanada/

(14) canada.cp.

(15) (canada or canadian$ or alberta or britishcolumbia or columbiebritannique).af.

(16) (saskatchewan or manitoba or ontario or quebec or new brunswick or nouveau brunswick).af.

(17) (nova scotia or nouvelle ecosse or prince edward island or ile du prince edward or newfoundland or terreneuve or labrador or nun?v?t or nun?v?t or nwt or territoires du nordouest or northwest territories or yukon).af

(18) (canada or canadian$ or alberta or britishcolumbia or columbiebritannique).in,jw,nw,jx

(19) (saskatchewan or manitoba or ontario or quebec or new brunswick or nouveau brunswick).in,jw,nw,jx

(20) (nova scotia or nouvelle ecosse or prince edward island or ile du prince edward or newfoundland or labrador or nun?v?t or nwt or northwest territories or territoires du nordouest or

(21) or/13-20

(22) 12 and 21

Appendix 2: Semi-Structured Interview Guide: Physician (Chapter 6)
Exploring Physicians Perceptions of Pharmacist Prescribing in Alberta

1. **Tell me about *your* practice.**

   ☐ What do you do daily?

   ☐ How (if at all) do you work with pharmacists?

2. **W*hat does the term pharmacist prescribing mean to you?***

   . How is it the same or different from other health care professionals' prescribing?

   How did you first hear about pharmacist prescribing?

3. **Tell me about the *last time you encountered pharmacist prescribing*.**

   - *Describe* the situation
   - Is this *typical*?
   - What *process* or standardized procedure do you follow when you or your staffs encounters pharmacists prescribing?
   - Approximately *how often* do you encounter pharmacists prescribing (overall/in general)?

4. **What *types* of pharmacist prescribing do you encounter in your practice?**

   - Probe for details regarding their understanding /definition of the different types of prescribing

     . If needed, list types of prescribing if they do not list (emergency, adapting (3 ways) and additional prescribing privileges to determine extent of prescribing.

5. What do you think about pharmacist prescribing overall?

6. I am interested in learning about your experiences with other non-physician prescribers. Could you describe any experiences you've had?

7. How has pharmacist prescribing *impacted your practice? Or it will impact your practice?*

- *Your patients*?
- *You*?
- *Others?*

8. Describe an *ideal situation* where you would feel *most comfortable with pharmacist prescribing*?

- Are there any particular therapeutic areas in which pharmacist prescribing is more frequent?
- How do you assess whether a patient is suitable for pharmacist prescribing?
- Which of the 3 types of pharmacist prescribing do you feel most comfortable with:
  - *Emergency, Adapting, or Additional prescribing authorization?*
  - Assess understanding of prescribing classifications

Demographic Information

1. Study ID number: _____
2. Gender:
   - ☐ (0) Male
   - ☐ (1) Female

3. I was first licensed as a physician in: _____ (year)

4. List any area of specialization:

    □ _____

5. Geographical Location:

    □ (0) Urban

    □ (1) Rural

6. Current practice setting:

7. Professional Activity

Appendix 3: Semi-Structured Interview Guide: Team Pharmacists (Chapter 6)

Exploring Physicians Perceptions of Pharmacist Prescribing in Alberta

1. **Tell me about *your* practice.**

   ☐ What do you do daily?

   ☐ How do you work with physicians?

   ☐ What is your relationship with physicians? How has this changed over time?

   ☐ How do you interact with community based prescribers?

   ☐ How do you prescribe (if at all) in this practice?

2. **Tell me about the last time you prescribed.**

   - Describe the situation
   - Is this typical?
   - What process or standardized procedure do you follow when you or your staffs encounters pharmacists prescribing?
   - Approximately how often do you encounter pharmacists prescribing (overall/in general)?

3. **What is the physician's reaction to your prescribing? How has this changed over time?**

4. **Tell me about the *last time you encountered pharmacist prescribing from a pharmacist outside the team (i.e., community pharmacist)*.**

   - Describe the situation
   - Is this typical?

- What process or standardized procedure do you follow when you or your staffs encounters pharmacists prescribing?
- Approximately how often do you encounter pharmacists prescribing (overall/in general)?
- How did the interaction with pharmacist change your attitude or behavior toward pharmacist prescribing?

5. **What *types* of pharmacist prescribing *g from a pharmacist outside the team (i.e., community pharmacist)* do you encounter in your practice?**
    - Probe for details regarding their understanding /definition of the different types of prescribing
        i. If needed, list types of prescribing if they do not list (emergency, adapting (3 ways) and additional prescribing privileges to determine extent of prescribing.

6. **What do you think about pharmacist prescribing overall? Both yourself and from a pharmacist outside the team (i.e., community pharmacist)**

7. **How has pharmacist prescribing (i.e., either yourself or community pharmacist prescribing) *impacted your practice? Or it will impact your practice?***
    - *Your patients*?
    - *You*?
    - *Others?*

8. **Describe an *ideal situation* where you would feel *most comfortable with pharmacist prescribing*?**

   - Are there any particular therapeutic areas in which pharmacist prescribing is more frequent?
   - How do you assess whether a patient is suitable for pharmacist prescribing?
   - Which of the 3 types of pharmacist prescribing do you feel most comfortable with:
     - *Emergency, Adapting, or Additional prescribing authorization?*
     - Assess understanding of prescribing classifications

Demographic Information

1. Study ID number: _____
2. Gender:
   - □ (0) Male
   - □ (1) Female
3. I was first licensed as a pharmacist in: _____ (year)
4. List any area of specialization:
   - □ _____
5. Geographical Location:
   - □ (0) Urban
   - □ (1) Rural
6. Current practice setting:
7. Professional Activity

Appendix 4: Consent form (Chapter 6)

Exploring Physicians Perceptions of Pharmacist Prescribing in Alberta

Part 1: Researcher Information		
Faculty of Pharmacy & Pharmaceutical Sciences: Chowdhury Farhana Faruquee, Lisa M. Guirguis (Tel: 780-492-9693) Department of Family Medicine: Dr. Sheny Khera		
Part 2: Consent of Subject		
	Yes	No
Do you understand that you have been asked to participate in a research project?		
Do you understand that your participation is voluntary?		
Do you understand what you have been asked to do in the research study?		
Have you received and read a copy of the information sheet?		
Do you understand the benefits and risks involved in taking part in this research study?		
Do you agree to be audio recorded (for transcription purposes) for the entire of the interview?		
Do you understand that you are free to stop your participation in the study at		

any time, without having to give a reason? You do not have to give a reason and it will not affect you in any way. The research assistant will stop the recording device right at that moment.		
Have you had an opportunity to ask questions and discuss the study? Who explained this study to you? _Chowdhury Farhana Faruquee_____		
Has the issue of confidentiality been explained to you?		
Do you understand who will have access to the information you provide?		
Do you give your verbal consent (in case of interview conducted over telephone) to take part in this study?		
Part 3: Signatures		
Signature of Research Subject: _____ Date:_____ Printed Name of Research Subject:_____ I believe that the person signing this form understands what is involved in the study & voluntarily agrees to participate. Signature of Investigator or Designee:_____ Date _____ **The Information Sheet must be attached to this consent form and a copy given to the research subject.**		