

**Evaluation of feasibility and potential impact of a clinical innovative software tool to support
pharmacists to prescribe for minor ailments.**

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Master of Science

in

Pharmacy

Waterloo, Ontario, Canada, 2023

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Background:

The role of community pharmacists has shifted from dispensing prescribed medications to providing patient-focused clinical services such as Pharmacists Prescribing for Minor Ailments (PPMA). These services are expected to improve patient care. Pharmacists across provinces have been given some level of prescriptive authority since 2005. The PPMA service was first introduced in Alberta. Currently, nine out of ten Canadian provinces have the authority for PPMA service. Ontario recently adopted PPMA, in January 2023. However, there are several barriers such as workload, time constraints and integration to workflow that can hinder pharmacists' ability to implement PPMA into existing practice. Technological solutions such as computerized decision support system (CDSS) can help pharmacists and facilitate performing PPMA service. PharmAssess Diagnostics developed a CDSS that provides a digital software platform for pharmacists to provide clinical services such as minor ailment prescribing. Although previous research examined the acceptability and impact of CDSS in other professions, there is paucity of research about the feasibility and impact of implementing supporting software tools into the workflow of community pharmacies on adapting PPMA.

Objective:

The aim of this project is to evaluate the feasibility and potential impact of a clinical innovative software tool to support pharmacists for minor ailment prescribing.

Method:

This project followed a mixed method design. It included an anonymous online survey and semi-structured interview with community pharmacists/pharmacy student interns to explore their

perspectives on the usability, acceptability, potential impact on integration in workflow and overall effect on workload while using the PharmAssess Diagnostics software for PPMA. In Ontario, pharmacists were recruited via the list of pharmacists in the Ontario College of Pharmacist (OCP) who agreed to be contacted for research purposes. Additionally, the co-op supervisors list from the School of Pharmacy University of Waterloo, and clients of the software company were contacted to be recruited. Demographic (age, gender) and professional characteristics (academic qualification, type of community pharmacy, current position in the pharmacy) were collected from participating pharmacists. Then, pharmacists' perspectives were examined using a survey with Likert's scale questions and were summarized. Descriptive statistics were used to describe the distribution of the responses.

Semi-structured interviews were conducted with pharmacists/student interns who were further interested in providing their detailed perspectives with the use of this software tool in community pharmacy settings. The interviews were analyzed thematically. Then both forms of data were merged using the side-by-side approach to draw conclusion.

Results: A total of 11 survey responses were collected. Pharmacists agreed that the software tool was usable (72%), acceptable (81%), had positive impact on workload (63%) and had positive impact on workflow (45%). Overall, 90% of participants stated that the average time per consultation using the software tool ranged between 5 to 15 minutes. Seven pharmacists were interviewed virtually. Three major themes emerged from the interviews, revealing usability of the software tool, facilitators, and barriers to the implementation of the software tool and impact of the software tool implementation into community pharmacy.

Conclusion: The implementation of the software tool is feasible as it is usable, acceptable and has positive impact on workload and workflow in the community pharmacy setting to facilitate pharmacist to prescribe for minor ailments. The implementation factors identified during this evaluation study can be used to customize the tool to increase its usability, effectiveness, and acceptability at the community pharmacy setting. The results can be also used in scaling this software tool at pharmacies to enhance PPMA service, which will ultimately optimize patient care.

Acknowledgements

I would like to thank my supervisor, Dr. Wasem Alsabbagh, for his encouragement, guidance, and continuous supervision throughout the course of my Master of Science degree. He gave me the opportunity to pursue a scientific field that was always my passion. He has supported me to go beyond conventional boundaries of science and research as a part of my career aspirations- for that I am extremely grateful. The skills I have gained because of his teachings is incomparable, particularly the quantitative data analysis using SAS programming. He also allowed me to work on other independent projects besides my thesis to gain various other skills and experience necessary to develop a successful career.

Secondly, I would like to thank my committee members, Dr. Elena Neiterman and Dr. Kelly Grindrod for all their support throughout my thesis. Dr. Elena's guidance for the qualitative piece and Dr. Kelly's ideas for the use of implementation framework added structure to my thesis.

Thirdly, I would like to thank Mitacs and PharmAssess Diagnostics Corp for funding this project.

Without this funding this project would not be the product it is today.

Lastly, but certainly not least, I would like to thank my family, and all my friends I made along my academic journey. Their continuous support and encouragement have helped me to thrive along the process.

Dedication

I would like to dedicate this thesis to my beloved mother Rokshana Asif, for her endless love, support, and encouragement. Her belief in me has made this possible today. I hope this achievement will fulfill the dream she envisioned for me.

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List of Abbreviations

AHFS American Hospital Formulary Service

APA Additional Prescribing Authorization

CPRC Council of Pharmacy Registers of Canada

CPhIS Community Pharmacy Intervention Study

GERD Gastroesophageal reflux disease

MA Minor ailment

MAAG Minor Ailment Advisory Group

NAPRA National Association of Pharmacy Regulatory Authorities

OCP Ontario College of Pharmacy

ON Ontario

OTC Over the counter medication

PAS Pharmacist Association Saskatchewan

PIN Personal identification number

PPMA Prescribing for minor ailment.

PPMS Pharmacy practice management system

Chapter 1

First Chapter

1.0 Introduction:

1.1 Role of community pharmacy

Community pharmacists provide quality patient care with the primary focus on providing safe and easy access to both prescription and non-prescription drugs.¹ In Canada, community pharmacies are self-proprietary businesses operated by single owner or organizations.¹ These pharmacies have various business models which follow an ownership structure and province specific regulation.¹ Pharmacy owners are important stakeholders within the community pharmacy business,² since each pharmacy differs in the way it is run by the owner. Despite the diversification, all community pharmacists play vital roles within the health care system. Pharmacists provide a wide range of services dispensing drug and related counselling, assessing appropriateness of prescriptions and monitoring safety and effectiveness of prescription drugs.^{1,3} However, the responsibilities of community pharmacists have broadened and developed in recent times with an aim to provide more primary care services for patients. In addition to providing pharmaceutical care pertaining to prescribed medications, pharmacists also regularly assess patients looking for primary care and provide proper treatment recommendations or make referrals to other healthcare practitioners.¹ As pharmacists are now able to deliver additional clinical services, this contribution in primary health care will enhance health outcomes.¹ Every week, almost half of the Canadian population visits a community pharmacy. Patients are up to ten times more likely to interact with their community pharmacists than their family physician.¹

1.2 Accessibility of community pharmacy

Pharmacists are the most approachable health care practitioner in Canada.⁴ As of January 1, 2023 there are 44,779 licensed pharmacists in Canada and the vast majority of them (69%) are practicing in 11,554 community pharmacies.¹ Moreover, the presence of substantial number of pharmacies across Canada has resulted in greater access for patients to receive care. A study conducted in Ontario evaluated the access of a community pharmacy and found that more than half of the residents lived in an area that had a pharmacy within near surrounding, while approximately 80-90% residents could reach to a pharmacy located within 2-5km driving distance.⁵ A similar pattern of pharmacy location was observed in Nova Scotia; however, the numbers differ due to urban and rural locations.⁶

1.3 Expanded scope of practice

The traditional role of community pharmacists has evolved recently and shifted towards patient centered care, and this enhanced the clinical services provided by pharmacists.¹ Canadian pharmacists' practice is governed by provincial regulations pertaining to scope of practice. The overall development of legislative authority has occurred non-homogenously across the country.⁷ Since 2005, every province has allowed some extent of authority to perform these clinical services.¹ Expanded clinical services involve medication reviews, vaccine administration, minor ailment management, smoking cessation programs, and changes to current prescription (renewal, extension and adaptations).^{1,8-10} In the broad list of added services, minor/common ailment management is a considerably new service.³ Pharmacists have a long history of helping patients with over the counter (OTC) medication.¹ With the recent development in the arena of practice, pharmacists across many provinces have been granted authority to evaluate patients with common and uncomplicated medical conditions often considered as minor ailments.⁷ The list of provinces with approved PPMA is available in **Appendix A** (this list has been updated recently after Ontario pharmacist received

approval to prescribe for MA in January, 2023) The PPMA service is provided by the pharmacist at a community pharmacy.³

1.4 Minor ailment

Minor ailments are generally defined as ‘common, self-limiting or uncomplicated conditions which can be diagnosed and managed without medical intervention’.¹¹ There are existing criteria to define minor ailment conditions as follows: it must be accurately self-diagnosed by patient that does not require laboratory tests, medical and medication histories for diagnosis, it can be easily recognized from more serious conditions, it is a self-limiting condition, treatment will not mask underlying conditions, and only minimum or brief follow up is needed.¹¹

Minor ailments are very common, and most people are likely to suffer through one or more episodes of these types of conditions in daily life.¹¹ The most common minor ailments in Canada are heartburn and indigestion, cold or flu, cough, muscle aches and pains, back pain, allergies, menstrual cramps, and insomnia.³ In a recent study, it was estimated that Canadian adults experienced 85 million colds/flu, 46 million episodes of indigestion and 82 million headaches in one year.³ Generally, when patients are ill, they try to determine the best possible way to return to health quickly. This process begins with assessment of symptom severity and the impact on quality of life, encompassing the context of their finances, social circumstances, and, most importantly, present health condition.¹² There are multiple approaches that can be taken by patients to deal with minor ailments. These include a wait-and-see approach, using non-medicated forms of treatment, taking some form of drug, or obtaining professional care such as visiting a pharmacist or a physician.³

Pharmacists assess the minor ailment condition by confirming the diagnosis using a series of open and closed-ended questions about the symptoms and if necessary, a physical exam.^{3,13} Pharmacists prescribe medications to treat minor ailment conditions following respective provincial guidelines.¹⁴

The documentation process is completed after looking into the patient's prescription profile,¹⁵ and record all available data that helped the care process. This is to ensure that safe and appropriate medication is chosen for the minor ailment while accounting all other medical conditions/prescriptions of the respective patient.¹⁵ Pharmacists also document a monitoring and follow-up plan to follow up with the patient to ensure the effectiveness and safety of the prescription.¹⁵

1.5 Guidelines of PPMA service by pharmacist

The rate and extent of PPMA service differ across provinces in Canada.³ The list of eligible medical conditions/drugs in provinces are provided in **Appendix B**. However, there is no national initiative for PPMA services; hence, the conditions approved within provincial minor ailment programs and the guidelines vary to some extent. For example, Saskatchewan pharmacists cannot deviate from the set protocols entailed for minor ailment prescription. However, this rule is not mandatory in Manitoba. The rest of the provinces (New Brunswick and Nova Scotia, Manitoba and Prince Edward Island) have a broader scope.³ On the other hand, certain provinces only have specific prescription drugs to choose for particular conditions, whereas others can follow a treatment algorithm to prescribe drugs.³ Despite the variation, the objective of the PPMA service is consistent and entails providing optimal care to patients that is both effective and safe – and of course convenient.

Until 2022, prescribing authority for minor ailments have been granted to pharmacists in eight out of ten Canadian provinces.¹⁴ Alberta became the first province to allow PPMA service in 2007.¹⁶ Since then, all other provinces have introduced some degree of prescriptive authority for their pharmacists. In 2011, Saskatchewan and Nova Scotia added minor ailments to their jurisdictions of pharmacists' services.¹³ This was followed by Prince Edward, Manitoba and New Brunswick in the year 2014.¹³ Newfoundland also got approval in 2015 to prescribe for minor ailment¹³ with the latest addition of

Ontario in 2023, and very recently British Columbia in June, 2023.¹⁷ I will focus the discussion on Ontario where this study was conducted. Ontario pharmacists recently received approval to perform PPMA service which got implemented in early 2023.

Ontario

Until recently, the scope of pharmacy practice in Ontario was rather restrictive.¹⁴ Only some authorized clinical services approved over the past few years form expanded scopes of activities (**Appendix B**). The minor ailments draft regulations had been submitted to Ministry of Health for approval and came into effect January 2023.¹⁸ The Ontario government has released the highly anticipated legislation that now allows pharmacists to diagnose and prescribe medications for common ailment conditions to the Ontario public. The amendments in regulation enabling pharmacists to provide minor ailments services started in May 2019.¹⁴ The following year, Ontario College of Pharmacists had been directed by the Minister of Health to submit draft regulations. The aim was to authorize pharmacists to prescribe drugs for particular minor ailments which shall allow greater access to primary care and reduce urgent care visits to physician's office or emergency department visits.¹⁴ The College decided (after consultation with the public and other professionals) that it was vital to incorporate certain factors while drafting the regulations to meet the required standards. The factors were as follows: reference from other provincial jurisdictions, experience of stakeholders (i.e., physicians, pharmacists, and patients), and entire healthcare system.¹⁴ The most important factors of this multifaceted draft required to define the regulatory framework, establish an expert advisory group and environmental scan and assessment.¹⁴ A Minor Ailment Advisory Group (MAAG) was formed to guide these changes in the regulations. MAAG derived data from quantitative and qualitative sources to comprehend the data to current context PPMA service across different Canadian jurisdictions. The primary findings were applied to an implementation framework

to make necessary modifications.¹⁴ MAAG used this foundational basis to guide selection of minor ailments to be included into the PPMA service in Ontario.¹⁴ The results drawn from this entire process backed up with health administrative data and wide engagement helped to deduce a list of twelve minor ailments. The list is available in **Appendix B**. The drugs approved to be prescribed for the 12 ailments following the American Hospital Formulary Service (AHFS) classification system are mentioned in the regulations.¹⁴ Along with other clinical services, minor ailment prescribing presents as arguably the most progressive leap in expanding pharmacists' scope of practice.

1.6 Rate of PPMA service across Canada

A large number of minor ailment consultations take place every year in pharmacies.¹⁹ A recent study in Saskatchewan estimated that approximately 28,000 minor ailment consultations had taken place within a population of approximately 1.2 million. A similar pattern was observed in Quebec where 323,000 minor ailment consultations took place in a year.²⁰ And these numbers appear to keep rising every year according to the reports of Canadian Foundation of Pharmacy.²⁰

1.7 Impact of PPMA service

Much of the research work until now has investigated pharmacist consultation skills, and pharmacist acceptance of the PPMA service or patient perception.^{21,22} There are limited studies focused on the clinical outcomes following the PPMA service. Even then, the results that are available in the literature seem optimistic.^{21,22} Overall, PPMA resulted in symptoms improvement and patient satisfaction. In one small study conducted in Saskatchewan, symptom resolution was high, with 86.7% of patients reporting a change that was significant or greater as a result of PPMA service.²² In terms of costs, it was estimated that instituting a pharmacist-led prescribing program involving nine minor ailments could save \$12.3 million over five years in Ontario alone.²³ This data is supported by a more recent study in 2021, where a decision analytic model was used to evaluate the potential

economic impact of setting up a reimbursement program for PPMA in Ontario.²⁴ The results from the study emphasize that enabling community pharmacists to provide PPMA service could potentially lead to large savings for the govt in Ontario.²⁴ Additionally, a survey stated that physicians in Saskatchewan think 10-30% of their consultations are commonly for minor ailments. If a sizable proportion of these consults were managed in the pharmacy setting, this could reduce the patient crowdedness and increase access to physician care.²⁵

While nonprescription drug therapy can effectively manage certain conditions, many minor ailments can be far more complex, often requiring prescription drugs for effective and long-term treatment.^{26,27} Under these circumstances, allowing PPMA would eliminate the need for many of these patients to seek care elsewhere (e.g., emergency department).^{26,27} A study was conducted in Ontario to calculate the proportion of emergency department (ED) visits that can ideally be managed by pharmacists for minor ailments.²⁸ It was found that under a broader scope, pharmacists could have handled nearly 1.5 million cases presenting to the ED in Ontario over the course of a seven-year study period.²⁸ Thus, it has a good impact on overcrowding in ED.²⁸ Moreover, the additional scope will also reduce unnecessary visits to physician's office thus improving the quality of care and increasing accessibility to prescription medication.^{24,28}

1.8 Pharmacist perspective on PPMA service

To implement PPMA service, it is vital to understand the dynamics of the program from the pharmacists' perspectives. This is because they are one of the key stakeholders determining the success of implementation of this program.² A newly published systematic review summarizing perspective of diverse range of stakeholders on pharmacist prescribing globally was predominantly positive, reaffirming previous research about the impact of the PPMA service.^{29,30} Pharmacists who have previously prescribed for minor ailment conditions or newly obtained this additional prescribing

authority, perceive the PPMA service positively.¹⁴ They are certain in their abilities and look forward to taking on the extra responsibility related with prescribing provided they are adequately reimbursed and have effective collaboration with other healthcare professionals.³¹ In a study conducted in Saskatchewan, pharmacist feedback was obtained on providing the PPMA service.²⁵ Most pharmacists estimated that the majority of patients came to the pharmacy with self-diagnosis. Almost half of pharmacists reported that approximately 10% of cases happen to be something more severe than patient's initial statement, but that pharmacists-led care could provide symptom relief for almost 70-90% of the patients who seek out the service.²⁵ Most of the pharmacists perceived that from 10% to 30% of encounters with community pharmacist may require additional medical care.²⁵

1.9 Barriers to PPMA service

Studies suggest that there are several factors that can hinder implementation of PPMA in community pharmacy settings. These barriers include integration of PPMA service within current workflow, excess workload, time constraints, and onerous paperwork associated with prescribing.³¹⁻³³

Workload and time constraints

Pharmacists are extremely busy professionals.⁴ Their daily workload continues to increase with the evolving scope of practice.⁴ Community pharmacists treat minor ailments regularly (even without legislative authority in place to provide PPMA service) with OTC medications. But pharmacists who have obtained the authority for PPMA service mentioned that such provision had raised their current workload in already busy, sparse and time-pressured environment.^{32,33} This is mainly because the PPMA service involves patient assessment, prescription generation or referral to physician, patient counselling and follow up, and record keeping. This results in longer encounters with each patient and adds burden to the existing workflow.

Integration into workflow

Integration of PPMA services into a busy community pharmacy setting can be a challenge. Additional services like PPMA require the pharmacist to generate a prescription involving a series of activities (mentioned in the above section) to complete the process and interrupt the pharmacy workflow (such as drug distribution services and other conical services). Therefore, community pharmacists need to be assisted appropriately to deliver PPMA services and manage the addition of this workload effectively, potentially through efficient use of staff, resources, and workflow changes.^{32,33}

Documentation

In past research, pharmacists report that PPMA services need onerous paperwork in order to generate a prescription for patient.³⁴ This involves documentation for the symptoms assessment, pharmacological and non-pharmacological plan of treatment, prescription writing, planning monitoring parameters and further communication to physician.¹⁵ The pharmacists reported this as cumbersome and time consuming.¹⁵

As these barriers are prevalent, it is important to address documentation challenges to ensure effective service can be provided. The documentation gap which is evidently hindering the implementation of the PPMA service in community pharmacy setting can be mitigated with the help of information technology (IT).³⁵ Technology can optimize the process thus facilitating more seamless implementation of PPMA, and thus increasing efficiency of care provided by pharmacist.³⁶

1.10 Technology use in Canadian community pharmacy

Despite always being in a time pressured environment, pharmacists still need to run a smooth workflow at their practice setting.³⁷ This have become possible with the help of technology to support delivery of patient care in accordance with Canadian regulations and standards.³⁷ There are some

common pharmacy practice management systems (under different brand names) and databases used in Canadian community pharmacies.

Pharmacy practice management system (PPMS)

PPMSs are information management systems used by pharmacists to deliver patient care.³⁷ Initially, PPMSs have been developed to support billing and dispensing processes. However, due to the rapid evolution in scope of pharmacy practice, there has been considerable advancement in these systems.³⁷ Even then, PPMSs may not be sufficient to serve all the latest pharmacy services such as PPMA. The PPMS can display, record, store, patient information in a way that efficiently manages the workflow within the conventional pharmacy dispensing activities. But it may not be sufficient to complete the series of steps and activities (mentioned in earlier section) to complete PPMA consultation by pharmacist.

But with the fairly new responsibility of PPMA across various Canadian provinces discussed considering the barriers to prescribing mentioned in earlier section 1.9, a technological solution is crucial to address this issue more efficiently. Clinical decision-making software may help pharmacists to prescribe for minor ailments more efficiently. This gap brings forth the need for innovative clinical software tools.

1.11 PharmAssess Diagnostics

Need for this technology

The Pharmacy Thought Leadership Summit held in 2016, published a research report where it said that over 80 percent of Canadian pharmacists struggle to provide advanced services due to excessive competing priorities and insufficient time in the workplace.³⁸ Therefore, with no mainstream assessment tool in pharmacy management software, there is substantial opportunity to create a digital

module such as clinical decision support system (CDSS) that can accelerate patient assessment, automate documentation, and streamline treatment selection.

Clinical decision support system (CDSS)

A conventional CDSS is a software or software tool designed to assist in clinical decision-making processes.³⁹ Here, patient-specific assessments/characteristics are linked to a knowledge database (which includes evidence-based recommendations and clinical guidelines)⁴⁰ within a computer system to tailor a decision for the clinician. The clinician later combines their knowledge with recommendations provided by CDSS to reach a decision.³⁹

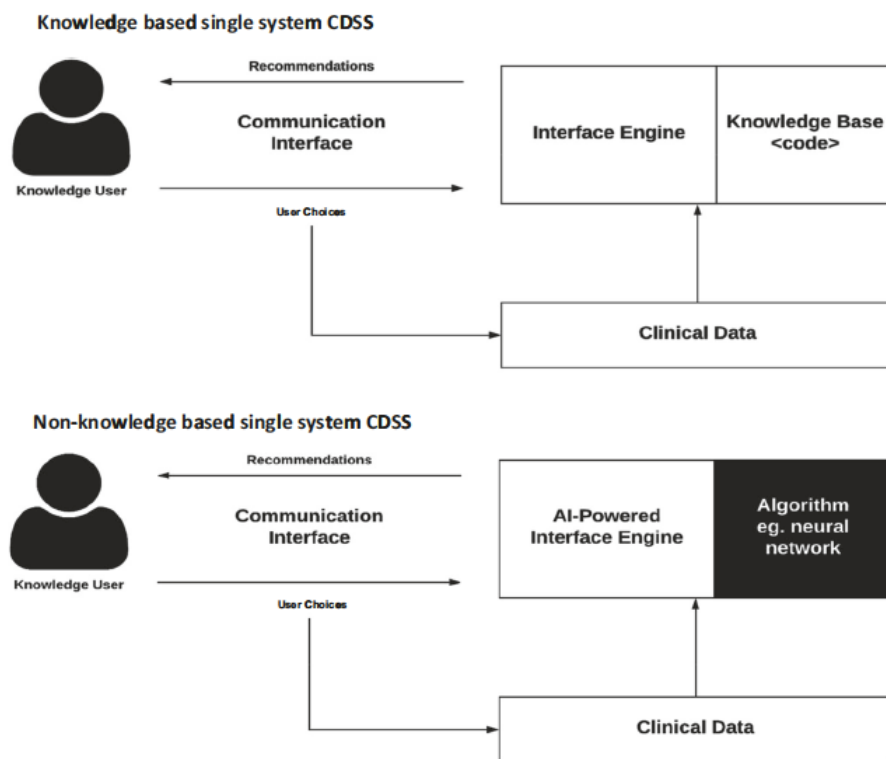
CDSS can be used as a stand-alone version or can be integrated with other management software used in the field of healthcare such as Electronic Health Records (EHR) and Computerized Provider Order Entry (CPOE) mostly in hospital setting.³⁹ It draws patient data from a variety of clinical information sources. When clinicians have all necessary information in one place, this facilitates the decision-making process, ensuring high quality patient care.⁴⁰ Literature suggests positive results about prescribing practices due to CDSS utilization.⁴¹⁻⁴³ However, little information is known about the use of CDSS in community pharmacy practice.⁴⁴ Provided the evident paucity of publications evaluating the implementation of CDSS in community setting, this opens an area of research whether CDSS, particularly when integrated with PPMS, considerably improve prescribing practice. CDSS can be administered through desktop, smartphone, and tablet.³⁹ This increases convenience as the system can be accessed from any platform.

CDSS can be classified into two main categories as knowledge-based or non-knowledge based.³⁹ In knowledge-based CDSS, rules to determine a clinical decision are based on literature, clinical practice, or patient-oriented data. This is all expert medical knowledge. The software retrieves data to evaluate the rule and generate a response i.e., clinical decision.³⁹ However, the non-knowledge-based

CDSS also needs a data source, but the clinical decision is dependent on machine learning (ML), statistical pattern recognition or artificial intelligence (AI)³⁹ that is programmed to follow a set algorithm and not medical knowledge only. Both types of CDSS have common components but with subtle differences illustrated in Figure.1 below.

Figure 1 Diagram of key interaction in knowledge-based and non-knowledge based CDSS

(Adapted from Reed and David 2020)³⁹



The scope of functions provided by CDSS is extensive. CDSS can be used for clinical management i.e., adherence to clinical guidelines, treatment protocols, prescription generation, and follow-up reminders.³⁹ The software can be also used for administrative function/automation i.e., auto-fill information by pulling patient data from information systems such as health records and, in the next

step, confirm diagnosis based on patient data matched to set algorithm.³⁹ CDSS can also assist in the patient counselling process. It can aid in selection of medication or patient referral.⁴⁴ This way CDSS can facilitate workflow by providing decision support and reduce clinician's cognitive workload.⁴⁵ In a study conducted in the US, prior to the implementation of CDSS, pharmacists struggled with the clinical documentation process involved in clinical care and increased workload.⁴⁰ However, CDSS implementation automated the workflow facilitating the pharmacists' led interventions. There was more than 100% increase in the number of interventions made by pharmacists within a period of one year.⁴⁰ This escalation in the number of interventions is indicative of the time saved through workflow improvement with CDSS.⁴⁰

PharmAssess overview

PharmAssess Diagnostics came forward to develop CDSS that provides a digital software platform for pharmacists that allows systematic provision of clinical services such as minor ailment prescribing. It was developed by a group of pharmacists who wanted to address the above-mentioned barriers to performing PPMA with a digital solution. This software tool automates pharmacy associated administrative work as well as increase patient access to clinical services. This software tool is a non-knowledge based CDSS which is dependent on AI, Machine learning and algorithm. This has been explained further in the software workflow section below. The following information was obtained by personal communication with PharmAssess. This tool has two modules: Minor ailment diagnostic tool and vaccination manager. In this thesis, the minor ailment tool will be the subject of discussion. By using this tool, via the mobile patient URL, patients (i.e., clients) can submit minor ailment assessment requests to their selected pharmacy. Alternatively, pharmacists can also use an interactive diagnostic interface for walk-in patients. Key features include automated documentation, prescription form filling, follow-up reminders, and assisted symptom/condition

identification (Details of workflow have been provided in the next section). This digital software platform is a stand-alone tool supported on any device with internet connection. PMS integration is also available, offering the following points of automation:

- Automatic population of additional fields from the patient's dispensing profile to complete the required documentation.
- Automatic entry of the billing Personal Identification Number (PIN) and/or associated prescription for each patient into the patient dispensing profile.

Software workflow

Patients can select their symptom from a menu of predefined minor ailments (approved in their province) and fill out information-gathering form using either a mobile device and/or desktop computer. Patients can submit the form to their choice of pharmacy. Otherwise, patients can also visit a pharmacy and state their symptoms to the pharmacist. The pharmacist can collect the information and enter it into the system. The pharmacist at the selected pharmacy will review the patient's self-assessment of symptoms by applying a proprietary classification algorithm. This algorithm is fundamentally based on MedSask's⁴⁶ (which is a source for healthcare practitioners to access medication-related information both prescription and OTC, particularly for the people in Saskatchewan) minor ailment prescribing and referencing peer reviewed therapeutic content from Compendium of Pharmaceuticals and Specialities (CPS)⁴⁷ and LexiComp⁴⁸. The CPS is a reference book that contains drug monographs. Lexicomp is a similar drug reference resource that also contains drug interaction screenings. These resources can assist healthcare practitioner to prescribe and use medication safely).

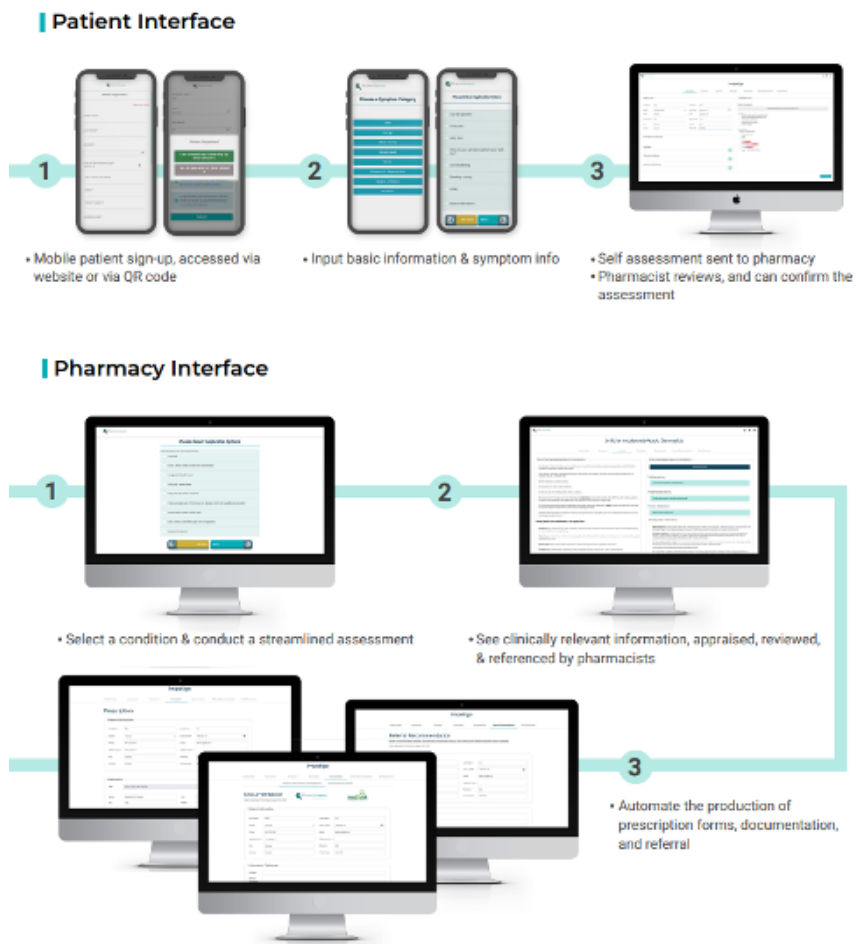
Thus, the PharmAssess diagnostic tool is designed to help the pharmacist assess the ailment and make treatment recommendations. It also automates prescription and documentation for the pharmacist. The

diagnostics, pharmacological and non-pharmacological recommendations, monitoring parameters, and medication information are all automatically generated based on set algorithm. The software currently features 47 minor ailment conditions following MedSask guidelines (provides algorithms for 27 minor ailment conditions for pharmacist in Saskatchewan to prescribe/bill for) and tertiary references mentioned above. The therapeutic content and design have already been incorporated following appropriate references for these minor ailments. The ultimate target is to expand the services to all provinces with approved PPMA service. The software can be customized according to the legislative guidelines of each province respectively. The associated documentation for the diagnostic assessment, treatment, prescription filling, and communication to physician is fully automated and shared with patients' family practitioners. The software automatically generates a document that can be uploaded to the PMS and automatically faxed to the doctor (although this process varies depending on the type of PMS).

The PharmAssess software is currently in use by many pharmacies in Alberta and Saskatchewan. This research study is focused on identifying software usability and implementation factors for further refinement so that it can be tailored according to Ontario's legislation (incorporating the current 13 MA conditions). This will ensure more acceptability and uptake of this software by pharmacies here in ON and expand its use in all other provinces.

The software workflow is illustrated in the Fig.2 below.

Figure 2 Software workflow



Preliminary survey conducted by PharmAssess

A preliminary survey of (N=10) community pharmacists practicing in Ontario was conducted by the PharmAssess company in August of 2020 and revealed that 90% of surveyed Ontario pharmacists report that the PharmAssess minor ailments software would be very useful. This information was obtained by personal communication with PharmAssess. The 9/10 pharmacists responded anonymously (results are available in the **Appendix C**).

1.12 Rationale for the study

As the traditional role of pharmacists has evolved from preparing and distributing medicines to patient-focused pharmaceutical care, this resulted in additional workload and time challenges in their existing workflow. Technology can play a major role to mitigate these challenges and facilitate pharmacists in their practice. Thus, quality of patient care and safety can be ideally transformed by utilizing Information Technology (IT) solutions.⁴⁹

Newly emerging technology such as CDSS are mostly being designed for multidisciplinary healthcare settings and use by physicians and nurse practitioners but can also be accessed by pharmacists to provide pharmaceutical services. In a pharmacy context, CDSS can assist in setting appropriate drug dose ranges, manage drug-drug interactions, ring clinical alerts for drug allergies, and provide clinical up to date information about drug therapy.⁵⁰ Literature suggests the use of CDSS to be beneficial in the area of healthcare.⁵¹ A systematic review on evaluating CDSS has shown that this kind of technology has improved professional performance such as detecting critical drug interactions due to availability of information to assist in clinical workflow.⁵² Therefore, pharmacists increasingly use CDSS but mostly in hospital pharmacy.

In community settings, pharmacists use PPMS to record patients and medication details.⁴⁴ However, pharmacists can also use PPMS for computerized prescription checks and alerts to manage clinical aspects of patient's care. CDSS can be used in this environment to provide warning in the form of reminders and alerts at the time of dispensing medication.⁴⁴ Likewise, CDSS has been known to be mostly used for assisting traditional pharmacy roles.⁴⁴

Overall gap in the literature

There is paucity of literature about the use of CDSS in community pharmacy practice.⁴⁴ A review article identified only six studies which examined the effect of CDSS directly supporting pharmacists

or pharmacy practice setting.⁴⁴ These studies evaluated the impact of CDSS only on medication counselling, drug-drug interactions, under-prescribing, and inappropriate prescribing,⁵³⁻⁵⁸ All these studies had a positive influence of CDSS on pharmacist activities mentioned above.⁴⁴ However, very limited investigation had been conducted on strategic ways to implement CDSS in community pharmacy settings, especially expanded scope of activities such as PPMA.⁴⁴

Context of practice

As discussed in section 1.10, PPMS are used in the Canadian community pharmacy to manage the overall workflow. Pharmacists use PPMS to perform their traditional roles. However, PPMA is a newer role which involves a series of steps to complete the process. But PPMS are not adequately designed to support new services such as PPMA. This justifies the need for new technology to bridge the gap. However, there is not much research pertaining to the feasibility of implementing technology solutions designed to facilitate PPMA service in community pharmacy. As a result, there is a gap in the literature related to the use, adoption or implementation of emerging technologies specifically designed for pharmacy practice such as the CDSS (developed by PharmAssess Diagnostics).

Moreover, PPMA service is also unique in Canadian context. This is because (as mentioned in earlier section) the service is not homogenized across all provinces. Each province has its respective set of approved minor ailments conditions and medications. There are many review papers about the economic importance²⁶ or impact of PPMA service in Canada^{3,12,21} or elsewhere such as Australia or UK^{11,32,59} but there is paucity of literature about impact of technology use from the pharmacists' perspectives.

Therefore, the goal of this study was to address this gap in literature and evaluate the usability, acceptability, and implementation factors of an emerging technology such as CDSS specifically designed for pharmacy practice. This study evaluated the feasibility factors associated with

implementing this software tool into community pharmacy specifically from the pharmacist's perspective. The aim was to use the results from this study to refine this software tool and expand its use. The results from this study can be generalized to implement similar technology in pharmacy practice settings.

1.13 Concept of Feasibility study

The goal of this feasibility study was to investigate the following components: usability (i.e., ease of use, effectiveness, efficiency, user satisfaction), acceptability and potential impact i.e., of using the software tool on the integration of PPMA into workflow and effect on workload.

A feasibility study was focused on evaluating if a particular intervention (i.e., clinical software tool for this study) determined the appropriateness for full-scale implementation.⁶⁰ It helped to identify factors which may influence the process or results of implementation.⁶¹ These factors were outlined in the form of barriers and facilitators which were assessed to determine the success and sustainability of implementation.

In this study, each of these feasibility components have a unique definition that has been systematically linked to the to evaluate this software tool appropriately. For example, this has been explained below. *Usability* is defined as 'the extent to which a product can be used by specified users to achieve goals with effectiveness, efficiency, and satisfaction in a specified context of use' by ISO 9241-11.⁶² Usability can be evaluated by measuring the following metrics mentioned in the definition. This study evaluated effectiveness in terms of enhanced delivery of PPMA service and better patient management due to use of this software tool. Efficiency was evaluated by including time needed to complete the task using this software tool. User satisfaction was evaluated based on user interface, navigation, and software workflow. All these usability metrics ultimately impact user acceptance of

new technology, which in this case was the software tool. *Acceptability* here was defined as common agreement that an intervention,⁶² i.e., the software tool, was satisfactory to use in a community setting. It was evaluated by assessing if the software tool helped to produce satisfactory results that was acceptable to deliver PPMA service.

The potential impact, i.e., of using the software tool on the integration of PPMA into workflow and effect on workload, was evaluated by assessing the barriers and facilitators to the implementation of the software tool.

It is also important to note that this is a feasibility study with the purpose of drawing evaluative conclusions about the feasibility of this innovative software tool. It clearly distinguishes from a research study that is rather empirical. Research studies are theory dependent with the application of findings on a broad spectrum.⁶³ The overall aim in research studies is to increase the body of scientific knowledge.⁶³ On the other hand, an evaluation study focuses on the application of findings⁶³ (Which in this case would be applicable to similar technological interventions targeted towards healthcare settings).

1.14 Theoretical framework used in this study: TAM, TAM2 and TAM3

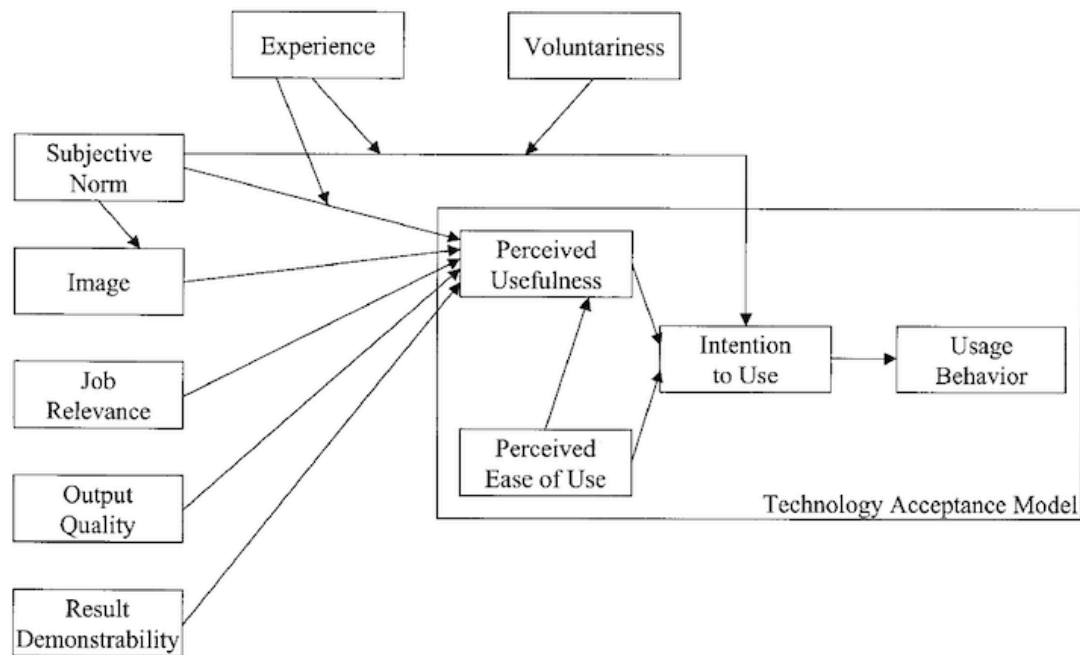
Since usability is multi-dimensional, it is important to incorporate all key constitutes of usability metrics as well as other related factors to complete this evaluation study. As such, a theoretical framework can bring all these metrics under one roof and provide a theory-driven approach to this study. A theoretical framework was necessary in this study design during conceptualization, to design data collection instruments such as questionnaire and interview guide and inform data analysis and interpretation phases.⁶⁴ A framework formed the link between quantitative and qualitative approaches in mixed design.⁶⁵ Since this was a mixed method study focused on evaluating innovative technology, these two factors guided the choice of a particular framework.

Technology Acceptance Model (TAM) and the extended version i.e., TAM2 and 3,⁶⁶⁻⁶⁸ is exclusively designed for modeling user's acceptance of information systems. The TAM is the former and basic version of this framework and it constitutes usability and acceptability.⁶⁶ To explain this elaborately, the basic TAM model is based on two factors i.e., 'perceived usefulness' and 'perceived ease of use'.⁶⁶ This theoretical framework claims that the usage of technology is driven by one's intention. When technology improves job performance, it can be considered as perceived usefulness. While technology that requires minimal effort to use can be termed as 'perceived ease of use'.⁶⁶ The TAM assumes if a technology is easy to use then the user is more convinced of its usefulness.⁶⁹ However, the later version of this model i.e., TAM2 includes additional theoretical constructs such as social influence processes and cognitive instrumental processes.⁶⁷ In TAM2, keeping the major constructs as umbrella terms, smaller constructs have been generated to explain the theory. For example, social influence processes include subjective norms, image, and voluntariness.^{67,70} These constructs collectively explain how/why social influence processes significantly influence perceived usefulness via *internalization*, i.e., when people consider social influences to shape their own perception of usefulness perceptions.^{67,70} This ultimately has a direct effect on intention for use in compulsory user setting. This study focused on the construct of subjective norm only (due to its relevancy to the concept of this study). The construct of subjective norm has been described more elaborately below.

On the other hand, the second major construct i.e., cognitive instrumental processes suggest that people perceive a system to be useful when it cognitively matches with their *job goals* and the consequence of using the system is positive i.e., *job relevance*. Apart from job relevance, people take into consideration how proficiently the system carries those tasks, which is referred to as perception of *output quality*.⁶⁷ The overall concept is to understand the effect of these additional usage intention

constructs on ‘perceived usefulness’.⁷⁰ Therefore, after extensive literature review, the TAM2 framework was chosen to holistically guide this feasibility study. Fig 3. illustrates the TAM2 framework.

Figure 3 TAM2 framework and its constructs (Adapted from Venkatesh and Davis, 2000)



Beginning with the *social influences*, its additional construct called subjective norm (that define people’s perception about using a technology is dependent on others recommendation)⁶⁷ is important to the context of this study. It guided the survey questionnaire where it is important to determine the study participants, i.e., pharmacists, intention to promote this software tool to their colleagues. Then, the three constructs i.e., job relevance, output quality and result demonstrability of the *cognitive* construct⁶⁷ were applied to guide this study. This can be explained by the following scenarios. Pharmacists ultimately perceived the software tool to have all the functions and capabilities to perform the desired task within a minimal amount of time. Additionally, pharmacists agreed that the

software tool provided an acceptable and comfortable way to deliver PPMA service to patients. And pharmacists agreed that usage of this tool reduced their workload and improved workflow while effectively delivering PPMA service to patients. Altogether, as the software tool is less effortful to use plus increased job performance, then it is likely to be used regularly in community settings.

The purpose of describing the TAM framework was to introduce the overall concept of technology acceptance driven by user perception. However, the extended model of TAM i.e., TAM2/TAM3 with additional constructs described above⁶⁶⁻⁶⁸ was used to design this feasibility study. It informed the conceptualization, design of data collection materials and interpretation of results.

Chapter 2

Second chapter

2.0 Methodology

2.1 Purpose of the study

PPMA is a relatively new service that has been added to the scope of pharmacists. This service has been implemented in most Canadian provinces and recently implemented in Ontario January 2023. Literature suggests that there are several barriers that impede pharmacists' ability to efficiently provide the PPMA service to patients. Pharmacists experience barriers such as difficulty integrating within workflow, excess workload and time constraints, and onerous documentation mentioned in chapter 1 of this thesis. Technological solutions can potentially overcome these barriers. As such, a new clinical software tool was developed, specifically designed to be used in the community pharmacy practice.

PharmAssess Diagnostics offers a digital software platform for pharmacists that enables efficient provision of clinical services such as minor ailment prescribing, allowing pharmacies to automate associated administrative work and increase patient access to clinical care. Previous evaluations were for tools appropriate to settings other than community practice. Plus, PPMA is a relatively new role for pharmacists; hence, there is a paucity of research about the feasibility and impact of implementing supporting tool/software into the workflow of community pharmacies on adapting PPMA. Therefore, evaluation of technological tools is essential to guide implementation and improvement of software tools for pharmacists.

2.2 Research question

Is the use of clinical software tool developed by PharmAssess feasible (in terms of usability, acceptability, and potential impact of software utilization in workflow) for pharmacists at community pharmacy setting?

2.3 Objective

The overarching objective of the study is to evaluate a clinical software tool to support PPMA.

Specifically, the following objectives were pursued:

- To examine usability of the clinical innovative software tool by pharmacists to support PPMA.
- To examine acceptability of using the clinical innovative software tool by pharmacists to support PPMA.
- To examine pharmacists' perspective of the potential impact of using the clinical innovative software tool i.e., integration into workflow and effect on workload

Hypothesis: There will be a high usability and acceptability of the clinical innovative software, and this would positively impact the adoption of this tool by pharmacists toward minor ailment prescribing.

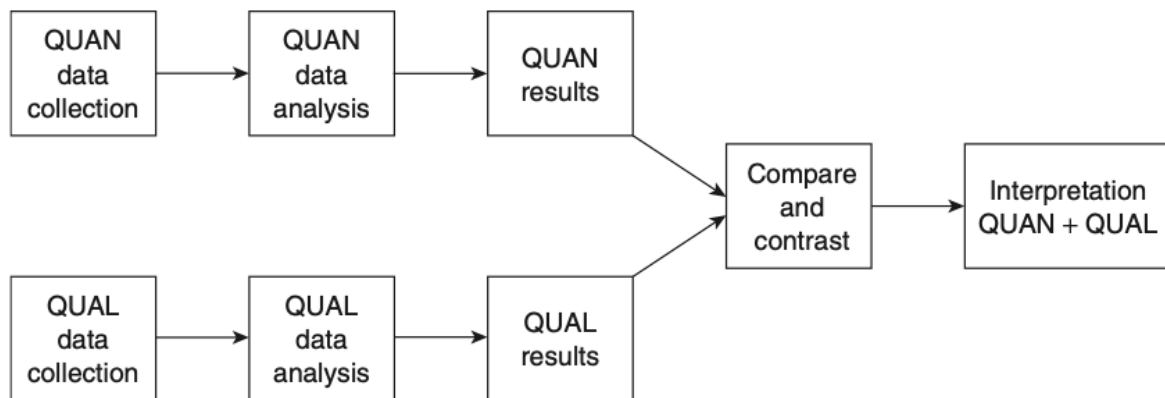
The results of this study may then support a wider adoption of advances in clinical services by pharmacists, thereby promoting further clinical services to provide optimal patient care by the pharmacy profession.

2.4 Study Design: Mixed method

A mixed method design was used for this study.⁷¹ The *methodological triangulation* design was followed. It is a one-phase design where the quantitative and qualitative phases are implemented to collect the data for the topic under investigation.⁷¹ Each form of data (quantitative and qualitative) was collected separately, and the different results were compared and contrasted during the

interpretation. Fig 4. illustrated the study design. This design is an appropriate approach to examine the research objective mentioned above to address the research gap. Moreover, the design was robust in incorporating both qualitative and quantitative research and reduce limitations of both approaches.

Fig 4 Triangulation Design: Convergence Model (adapted from Creswell & Plano-Clark, 2007)



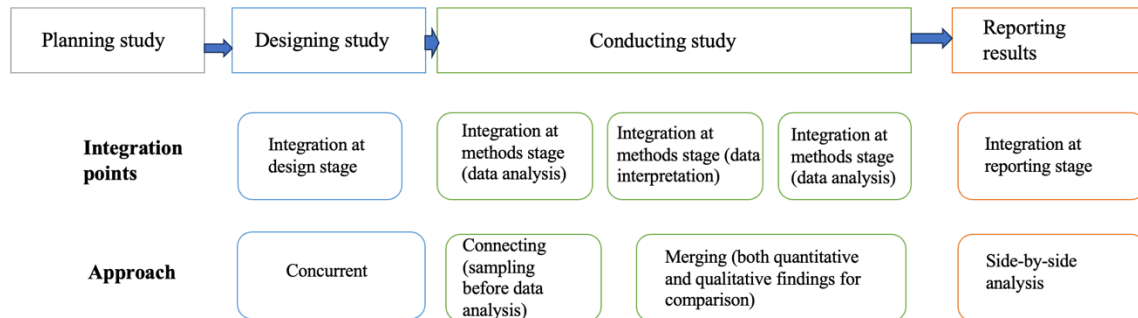
To collect quantitative data, an online cross-sectional survey was developed. It was distributed by the University of Waterloo Survey Research Centre (SRC).

To collect qualitative data, semi-structured interviews were conducted with pharmacists to collect in-depth data about the clinical innovative software tool to support pharmacists' prescribing for minor ailments.

Integration points in the mixed method design

Systematic integration of each phase of a study at multiple points depict a good-quality mixed methods design.⁶⁵ There were three main points of integration that occur in mixed method study (i.e., design stage), method level and interpretation or reporting level.⁶⁵ This study involved integration at all three stages which has been demonstrated using a procedural diagram in Figure.5.

Figure 5 Integration points across the course of the mixed method study.



Beginning with the design stage as the first point of integration, this mixed method study followed a concurrent approach where the quantitative and qualitative phases had run simultaneously.⁷¹ The next stage i.e., method, involved multiple points of integration at data collection, analysis and interpretation level following distinct approaches. The *connecting* approach was used during data collection where the participants from the qualitative phase were selected from the quantitative preceding quantitative analysis.⁶⁵ Here, the two individual phases were connected by sampling. Although, data from both phases were analyzed individually, but it was brought together for mixed level analysis. This approach is known as *merging* where data was compared, evaluated for similarity between phases or even explore any differences between findings.⁶⁵ Finally, at the reporting stage, integration was achieved by presenting results in a side-by side analysis.^{65,71} Here, the results were organized side-by-side and explained in a discussion form (details has been explained in section 2.16)

2.5 Rationale for study design

The choice of concurrent triangulation design was informed by the research question and the objectives under examination of this study. Secondly, the single-phase timing of this design was time efficient because both qualitative and quantitative data were collected simultaneously.⁷¹ And as this

study sought to have equal emphasis on both forms of data, the aim was to provide a better understanding of the topic under investigation i.e., feasibility of this software tool that was utilized in a community pharmacy setting. Finally, this design provided distinct types of information but together they produced results that matched.⁷² Any form of incongruence in findings has been explained in this design. Therefore, this design was the best choice to conduct this study.

2.6 Quantitative: Rationale for cross-sectional survey

There are two types of survey methods, namely: cross-sectional and longitudinal survey.⁷² The main difference is that a cross sectional survey studies the sample in one single point of time while in longitudinal surveys, the sample is studied at multiple points of time. This study followed the cross-sectional method where the target population was observed at a specific point in time. The participants were selected based on variables of interest— i.e., pharmacist/pharmacy student intern interested to prescribe for minor ailments and working in a community pharmacy setting. Thus, this method complemented the objective to examine usability, acceptability, and participants perspective of potential impact of using this clinical software tool during minor ailment prescribing. The selection was further justified by the nature of each of these components. These components that were being studied were all implementation factors which were not supposed to change over the course of time with a specific sample. Moreover, this survey method also allowed us to collect detailed information over a short period of time. Data was obtained inexpensively through an online survey.

2.7 Qualitative: Rationale for semi-structured interview

This study utilized semi structured interviews to obtain data from a particular group of individuals. This interview technique was flexible in nature as the interview guide consisted of a series of questions with follow-up questions.⁷³ Typically, the language or wording of the questions were customized by myself to accommodate the context of discussion.⁷³ This allowed me to obtain deep

insight into participants' perspectives and experiences.⁷³ This helped to gather subjective information about the topic of study, which in this case was the feasibility of using this software in a community pharmacy setting.⁷³ The semi structured interviews were most commonly used in the context of healthcare.⁷³ This exploratory data obtained from the in-depth semi-structured interviews generated additional themes complementary to the quantitative data. This exploratory data obtained from the in-depth semi-structured interviews generated additional themes complementary to the quantitative data during side-by-side analysis. Therefore, this data helped to test the hypothesis of this study mentioned in section 2.3 of this thesis.

2.8 Sampling and Recruitment method

The principal investigator requested data (i.e., contact information of community pharmacist) from the following sources: Ontario Pharmacy Evidence Network (OPEN) who has a data sharing agreement with Ontario College of Pharmacist (OCP), University of Waterloo, school of pharmacy Co-op supervisor, and PharmAssess client base.

This study followed a *convenience sampling* method for the quantitative survey. This is a non-probability method that involved samples being gathered from that part of population that was easily accessible.⁷⁴ This method was being followed because it was difficult to recruit a large number of pharmacists to participate in this study as they were already burdened with additional workload due to COVID-19 pandemic and with the recently approved PPMA service in Ontario.

The inclusion criteria included pharmacists/pharmacy student interns interested in prescribing for minor ailment in the province of Ontario, practicing regularly at least 8 hours/ week at a community pharmacy. This criterion generalized the results for individuals similar to the sample.

This approach of sampling has been frequently used in quantitative/qualitative studies as it provided participants, that had the capacity to provide elaborate information, relevant to the topic under investigation.⁷²

However, for the qualitative interview, *purposive sampling* method was followed. Participants who had completed the survey and consented to be invited for an interview were purposefully selected (following their demographics information such as age, years of pharmacy practice) to take part in a one-on-one semi-structured interview. The idea was to have a diverse sample. All stakeholders including pharmacy owners and staff pharmacists were included in the sample for this phase of the study to obtain detailed perspective about the software tool.

2.9 Sample size

Quantitative

The aim was to recruit as many participants interested to take part in the survey. There was no formal sample size calculation required for convenience sampling.

Qualitative

All participants (from the quantitative survey), those who were willing to take part in the qualitative interview and had provided their consent and contact information were purposively selected to take part in the interview.

2.10 Description of survey material

The purpose of this survey was to generalize from a sample to a population so that deductions could be made about using a new technology that was a software tool for clinical purposes, in a community pharmacy setting. In this survey, a sample of pharmacists practicing at community pharmacy settings gained access to the software at the beginning of the study and used it to solve 5 MA patient case

studies. Then conveyed their perception about the usability and acceptability and potential impact of using the software while prescribing for minor ailments. This data additionally helped to understand and explained the bottlenecks to implementation of this software for routine use in clinical practice.

The survey questions collected the following information: pharmacists' personal demographics (i.e., age, and gender) academic qualification (i.e., BSc, Pharm D, MSc and PhD), title or current position in pharmacy (i.e., manager, owner, full-time staff, part-time staff, freelance/relief) and type of community pharmacy (independent, chain, banner, franchise, mass merchandiser/food store). Then, questions pertaining to the following themes of pharmacists' perspectives were examined in the survey: usability, acceptability, and potential impact of utilizing the software tool in community pharmacy setting.

Feasibility of implementing this software tool in community pharmacy for MA prescribing was evaluated by assessing several factors including usability (i.e., ease of use, effectiveness, efficiency, and user satisfaction), acceptability and potential impact on workflow and workload.

Usability

Usability for this software tool was evaluated as the extent to which it was easily learned, remembered, and used effectively and efficiently by pharmacist to support clinical decision making for MA prescribing. User satisfaction was another component of usability. It referred to the level of satisfaction with the overall performance of this software tool.

Ease of use

Ease of use followed the reference from TAM framework (construct: perceived ease of use), pharmacist will accept the software tool and use it in daily practice provided it required minimal effort to learn and use.⁶⁷

Effectiveness

Effectiveness of this software tool referred to the ability of the system to improve delivery of PPMA service. This component was evaluated based on the following TAM2 constructs: job relevance (i.e., consequence of using system is positive and applicable to job), result demonstrability (i.e., the results of using the software tool are tangible, observable, and communicable) and output quality (i.e., proficiency of the system in carrying out the task).⁶⁷

Efficiency

Efficiency was measured by the time and resources required to make clinical decisions with the support of this software tool.

User satisfaction

User satisfaction referred to the level of satisfaction that pharmacist had with the overall performance of the software tool. There were several factors that contributed to the user satisfaction of this software tool, i.e., intuitive user interface, software workflow, and easy navigation.

Acceptability

Acceptability referred to the willingness of the pharmacist to use this software tool for MA prescribing in regular practice. Acceptability of this software tool was also dependent on two other factors including: *potential impact on integration to workflow and overall impact on workload.*

Usability as well as other components of feasibility were measured using the 'mHealth App Usability Questionnaire (MAUQ)' scale⁷⁵ plus, 3 additional questions. The MAUQ questionnaire has been designed by researchers based on number of existing, well-validated questionnaires such as System Usability Scale (SUS) and Post-Study System Usability Questionnaire (PSSUQ) that has been previously used to in mobile app usability studies.⁷⁵ but these questionnaires were not specifically

designed to evaluate the usability of mobile Health apps.⁷⁵ Therefore, the 21-item MAUQ with answers on a 7-point Likert scale ((1 strongly disagree, 2 disagree, 3 somewhat disagree, 4 neutral, 5 somewhat agree, 6 agree, 7 strongly agree) was a more appropriate questionnaire because it was designed considering mobile devices and mHealth apps.⁷⁵ Additionally, there are four different versions according to the type of app (interactive or standalone) and target user of the app (patient or provider).⁷⁵ Since the PharmAssess software tool is an interactive app (user can send and receive information via the app), that is going to be used by the pharmacists, therefore that particular version of the questionnaire was used in this study (the details can be found in **Appendix D**). This survey questionnaire consisting of MAUQ along with four other questions (regarding average time taken to complete each consultation using the software tool, impact on workload, impact on workflow, and future recommendation to colleagues) developed by adopting literature was used to examine all the components of feasibility i.e., usability (i.e., ease of use, effectiveness, efficiency, user satisfaction), acceptability, and potential impact of using the clinical software tool on the integration of PPMA into workflow, and effect on workload. The constructs of the TAM2⁶⁶ theory informed a significant portion of the contents in this survey questionnaire.

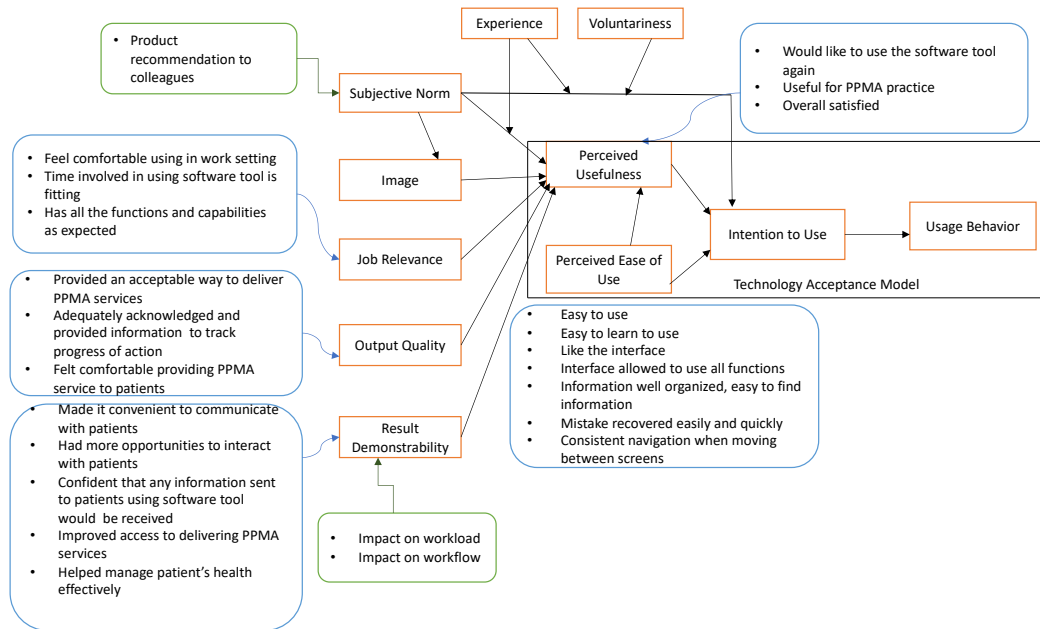
The contents of the survey questionnaire (consisting of MAUQ as well as questions developed by myself and adapted from previous literature) was organized according to the constructs of the TAM2⁶⁷ framework. This has been illustrated in Figure 7. This mapping of survey content with framework constructs ideally helped to tie each of the components of feasibility i.e., usability (i.e., ease of use, effectiveness, efficiency, user satisfaction), acceptability and potential impact i.e., integration into workflow.

Additionally, the TAM2⁶⁷ framework also guided the qualitative method during data collection such as informing the semi-structured interview guide (questions are available in **Appendix**) The TAM3

framework guided the data analysis phase. It helped to organize the evolving themes and interpret the results. Altogether the TAM2/TAM3^{67,68} framework served as a common connection between both form of approaches (i.e., qualitative and quantitative)

Therefore, as this study analysis supported that this software tool is feasible, this ultimately proved the TAM2⁶⁷ framework that targets users i.e., community pharmacists have the intention to use this software tool in a work setting.

Figure 6 Mapping of survey content to TAM2 constructs



Keys

- Questions from MUAQ scale
- Questions developed adopting literature
- TAM2 constructs
- ➔ Arrows connecting MUAQ questions in the survey with TAM2 constructs
- ➔ Arrows connecting TAM2 constructs within the model

The reliability and validity of the MAUQ were evaluated to assess the usability of the PharmAssess software tool. Psychometric analysis demonstrated that the MAUQ possesses three reliable subscales, and their internal consistency was found high.⁷⁵ Furthermore, the relevant subscales of the MAUQ exhibited strong correlations with the subscales of the PSSUQ (Post-Study Usability Questionnaire). Additionally, the overall scale of the MAUQ showed a strong correlation with both the PSSUQ and SUS (System Usability Scale).⁷⁵ These findings suggest that the MAUQ is a reliable and valid tool for

evaluation the usability of the PharmAssess software tool, as it demonstrates consistent and meaningful relationships with established usability assessment measures.⁷⁵

The scales used in this survey were freely available for use and did not require any permission from the author.

2.11 Survey validation

This MAUQ is an already validated questionnaire that has been used in multiple studies. Therefore, no further validation was required to be used in this feasibility study.

2.12 Description of semi-structured interview

A semi-structured interview with each participant was scheduled live on Microsoft Teams. I developed a set of questions guided by the TAM2 theory as well as adapted from previously published literature. These questions were used to facilitate the discussion. The duration of this discussion was approximately 25-35 minutes depending on the context. The question guide has been added in **Appendix E**.

2.13 Ethical consideration

Ethics approval was obtained from the Office of Research Ethics (REB), University of Waterloo (approval, protocol # 44005). During the recruitment process, when participants agreed to participate in the study, the consent to was obtained.

2.14 Study setting

The study setting involved community pharmacies located in the province of Ontario, Canada. A description of the setting has been provided in chapter 1 of this thesis.

Privacy

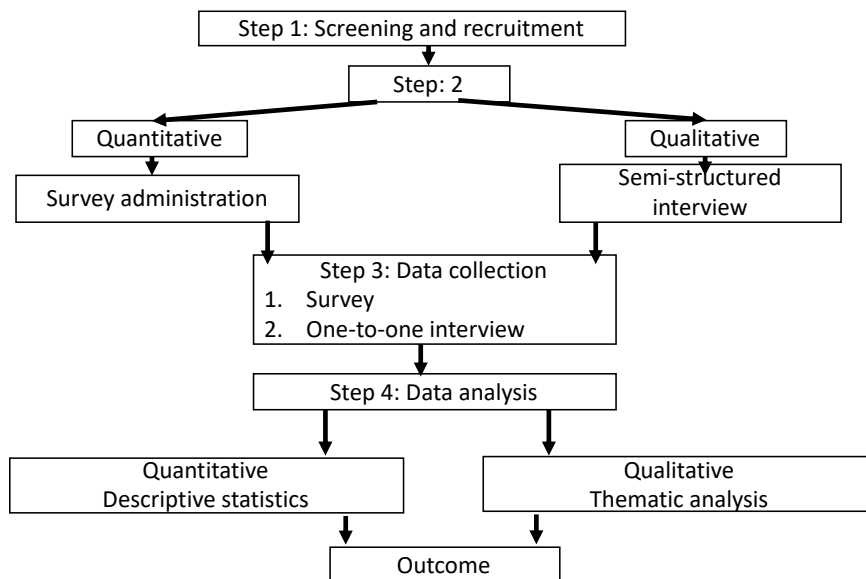
SRC stored the information anonymously and only showed the investigator unidentified results. SRC used Transport layer Security (TLS) encryption for all transmitted internet data and servers were protected with high-end firewall systems. All SRC accounts were password protected. The participants were not asked to input contact information directly into the survey questionnaire. Participants were only asked for this information on a separate contact form (so that they could be sent software account login information). This contact information was also used by SRC when participants were additionally interested in taking part in one-on-one interview after completing the online survey. The questionnaire and consent form with participants contact information was maintained by SRC. The contact information was downloaded and removed by SRC at the end of the survey. It was stored on a password-protected computer kept in the school of Pharmacy's Health Services and Applied Research lab (HS&ARL). Contact information was stored separately from the rest of the data and deleted at the end of the study.

Data Storage

SRC stored the information anonymously. SRC used encryptions for all transmitted internet data. The video and audio recordings collected during the online interview were encrypted and stored securely in a separate password-protected computer kept in HS&ARL.

2.15 Study procedures

Figure 7 Study procedure



Step 1: Screening

The participants were recruited following the sampling method and inclusion criteria respective to the quantitative and qualitative section of this study.

Consent

Participants provided online consent by clicking on to a checkbox to ensure their participation into the study. Additionally, those who were interested in taking part in a one-on-one interview provided consent at the end of the online survey. All the recruited participants were provided with an information letter. This letter comprised a brief description of the study, purpose of the software tool, information about video tutorials on how to use the software and taking part in an online survey and semi structured interview. The letter also stated the information that participation was completely voluntary, but incentive based. The participants obtained 90 days free subscription to the PharmAssess software.

Step 2: Dissemination of the software

Training

A webinar session was provided to introduce the software tool to all registered participants. This was facilitated by the software development company (i.e., PharmAssess). The webinar was approximately ½ hour. All the participants had the opportunity to ask questions about the study and/or about MA prescribing scenario in ON.

A mutually agreed date and time was obtained from the participants to conduct this session. For participants who cannot attend the session: a recording of the webinar was provided. As the participants were required to register with the software company to take part in the study therefore, at any time after account registration, users may visit the ‘Help & Tutorials’ page on the portal dashboard, which will include supplementary onboarding tutorial videos and a section for Q&A. Pharmacy management system access.

The standalone version of this software tool is a web-based application; Therefore, it can be accessed at any time using a computer connected to an internet source.

Step 3: Participation in the study

Survey

A single survey questionnaire was administered to the participants in ON. The participants had to use the software to solve 5 simulation case studies (added in **Appendix F**) and then take part in the survey. The survey will be conducted by SRC.

Semi-structured interview

Participants who have completed the survey and consented to be invited for interview were purposefully selected (following their demographics information such as age, years of pharmacy practice, experience/inexperience with PPMA) to take part in one-on-one semi-structured interview. The idea is

to have a diverse sample. All stakeholders including pharmacy owners and staff pharmacists were included in the sample for this phase of the study to obtain detailed perspective about the software tool. A mutually agreed date and time was obtained by me to hold a virtual interview session that was conducted via UW licensed Microsoft Teams/Zoom. The data was collected in the form of audio and video recordings. The video recordings were encrypted and securely stored in a password protected computer for a minimum of 7 years.

Pharmacy Management System Installation

This software can be used as a standalone or integrated version. The later version can be integrated with the PPMS and facilitate pharmacists in their workflow and allow them to work more efficiently. This version can pull patient data from the PPMS and automatically fill out information to generate prescription. However, the integrated version of the software required Access Point TM Middleware (a product of Pharmacy Access Solutions Inc. PASI) on the main server of the pharmacy. The installation can be completed remotely (by the software company) but will require a one-time fee of \$150 to be paid by the respective pharmacy.

Since this clinical software tool is a new technology for the pharmacist, familiarization with the product is necessary before the integrated version involving a cost is offered. Therefore, this study offered the standalone version of the software tool to the pharmacist for the study period. The standalone version of this software tool is a web-based application; therefore, it could be accessed at any time using a computer connected to an internet source.

As an incentive, pharmacists could use the software tool without any monthly charges for a period of 90 days. If pharmacists were interested, they could get the integrated version of the tool by paying the one-time fee. Since the integrated version was optional, pharmacists could switch to this version at any point of time during or after the study period.

Step 4: Data analysis

The convergent design used in this study has a strategic data analysis procedure. Data triangulation took place in the data collection phase where two different forms of data i.e., quantitative survey and qualitative interview were collected.⁷¹ Then, each form of data was analyzed individually (roughly at the same time) and ultimately merged to deduce final result. There are several ways to *merge* the two databases. This study followed joint-display where the results were organized *side-by-side*.⁶⁵ This involved reporting the quantitative statistical results and comparing it with the qualitative findings (e.g., themes) in a discussion form. This way, each form of data was further validated and used to confirm or disconfirm the statistical results. The side-by-side approach was more appropriate for this study compared to the alternative i.e., single visual to integrate data sets and communicate findings. This was because when additional themes were generated from the qualitative interviews, it became complicated to present with the data obtained from the survey (with set questions and answers in Likert scale only). Therefore, it was more logical to interpret data in the form of discussion.

Quantitative

After the completion of the survey, the responses were recorded on a data sheet in Microsoft Excel. Descriptive statistics were used to summarize the data and included percent agreement in the responses from the survey questionnaire.

The Likert-scale value ranges from 1 to 7. The score was calculated in the following way:

In this questionnaire, 0 - Disagree to 7 - Agree. To determine the usability of an app, I calculated the total and determined the average of the responses for each statement. The higher the overall average, the higher the usability of the app.⁷⁵ Bar charts and frequency tables were used to visualize the data. Microsoft Excel was used to analyze the data.

Qualitative

The data obtained from each semi-structured interview was analyzed using *thematic analysis* technique. This method involves structured method of coding of data by organizing the information into categories to deduce patterns.⁷⁶

Procedure for content analysis

Step 1: Transcription

The interview was recorded in Microsoft Teams/Zoom and transcribed verbatim (word for word).

Step 2: Familiarization with data

The transcribed file was read multiple times to get familiarized with the data.

Step 3: Coding

After familiarization, the transcripts were read line by line, applying a paraphrase or label (a 'code') that described important sections of the passage. This section followed a combination of inductive and deductive coding method. The deductive codes were obtained from the TAM2 and TAM3 framework. All data were coded manually and stored onto QSR NVivo software for further access during the analysis process.

Step 4: Developing categories and subcategories.

Numerous categories of codes were generated to list emerging ideas, draw relationships, and identify keywords frequently used by respondents as indicators of important themes. Furthermore, the codes were grouped together into subcategories. Recurring ideas and wider themes were identified at this stage to draw quantitative comparisons across interview transcripts.

Step 5: Interpreting the data.

The major emerging themes helped to identify the components of feasibility to be examined in this study.

Chapter 3

Third chapter

3.0 Results

3.1.1 Sample

From 6810 pharmacists and interns who were invited to participate in the study (after 2 ethics application amendments to increase participation), my sample had a total of N=11 respondents (Figure 8).

Figure 8 Recruitment flow chart

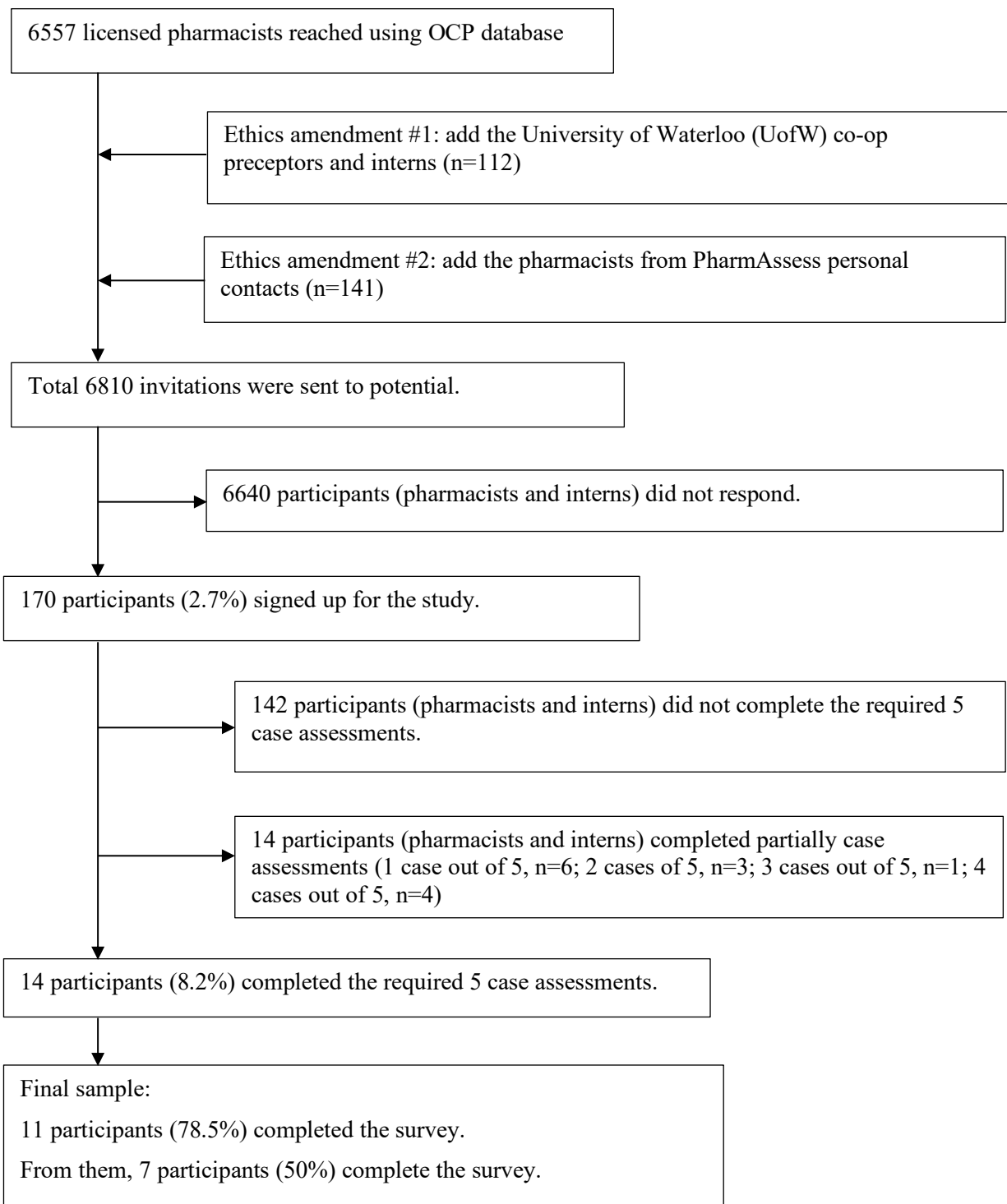


Table 1 summarizes participants' characteristics. There is an equal percentage of male (45%) and female (45%). Most participants (72%) are between the ages of 20-50 years, 45% have BSc and another 36% have PharmD degree. There is a variance in pharmacy position across participants (i.e., manger, owner, full-time staff, part-time staff, and freelance/ relief) demonstrating representative sample of ON community pharmacist.⁷⁷

Table1 Surveyed participants demographic information

Characteristics	Participants, n of N (%)
Gender	
Woman	5 of 11 (45%)
Man	5 of 11 (45%)
I prefer not to answer	1 of 11 (9%)
Age (y)	
20-30	3 of 11 (27%)
30-40	2 of 11 (18%)
40-50	3 of 11 (27%)
50-60	1 of 11 (9%)
60-70	2 of 11 (18%)
Academic qualification (degree/certificates)	
BScPhm	5 of 11 (45%)
PharmD	4 of 11 (36%)
PhD.	1 of 11 (9%)
PharmD candidate	1 of 11 (9%)
Title/current position in pharmacy	
Manager	3 of 11 (36%)
Owner	2 of 11 (18%)
Full-time staff	1 of 11 (9%)
Part-time staff	3 of 11 (27%)
Freelance/ Relief	2 of 11 (18%)

Type of community pharmacy	
Independent	5 of 11 (45%)
Chain	0 of 11
Banner	4 of 11 (36%)
Franchise	1 of 11 (9%)
Mass merchandiser/ Food store	1 of 11 (9%)

3.1.2 Quantitative results

The survey results pertaining to implementation outcomes are outlined in Table 2. The results showed that, 72% of participants agreed that this software tool was usable (average 5.1/7), 81% agreed that it is acceptable (average 5.4/7), 63% agreed on positive potential impact on workload (average 4.6/7) and 45% agreed on positive impact on current workflow (average 4.7/7). Overall, 90% of participants stated that the average time per consultation using the software tool ranged between 5 to 15 minutes. The MAUQ questionnaire with average Likert scale response score has been summarized in Table 2 below.

Table 2 MAUQ questionnaire with average Likert scale score

#	Statements	Average Likert scale score (N=11)
1	The software tool was easy to use.	5.1
2	It was easy for me to learn to use the software tool	5.5
3	I like the interface of the software tool	5
4	The information in the software tool was well organized, so I could easily find the information I needed.	6.1
5	I feel comfortable using this software tool in community settings.	5.5
6	The amount of time involved in using this software tool has been fitting for me.	4.9
7	I would use this software tool again.	5.1
8	Whenever I made a mistake using the software tool, I could recover easily and quickly.	5
9	This software tool provides an acceptable way to deliver PPMA services.	5.4
10	The software tool adequately acknowledged and provided information to let me know the progress of my action.	5.6
11	The navigation was consistent when moving between screens	6.2
12	The interface of the software tool allowed me to use all the functions (such as entering information, responding to reminders, viewing information) offered by the software tool).	5.5
13	This software tool has all the functions and capabilities I expected it to have.	5.5
14	The software tool would be useful for my PPMA practice.	5.3
15	The software tool improved my access to delivering PPMA services.	5.2
16	The software tool helped me manage my patients' health effectively.	5.4
17	The software tool made it convenient for me to communicate with my patients.	5
18	Using the software tool, I had many more opportunities to interact with my patients.	5.1
19	I felt confident that any information I sent to my patients using the software tool would be received.	4.9
20	I felt comfortable providing PPMA service to my patients using the software tool.	5
21	Overall, I am satisfied with this software tool.	5.1

Ease of use

The average Likert scale score for each of statements 1,2,5 and 20 (Figure 9.A to 9.D) which evaluated ease of use component ranged between 5.0-5.5, with overall average of 5.3. The distribution of responses for each of these questions has been stated below.

Figure 9.A Ease of use

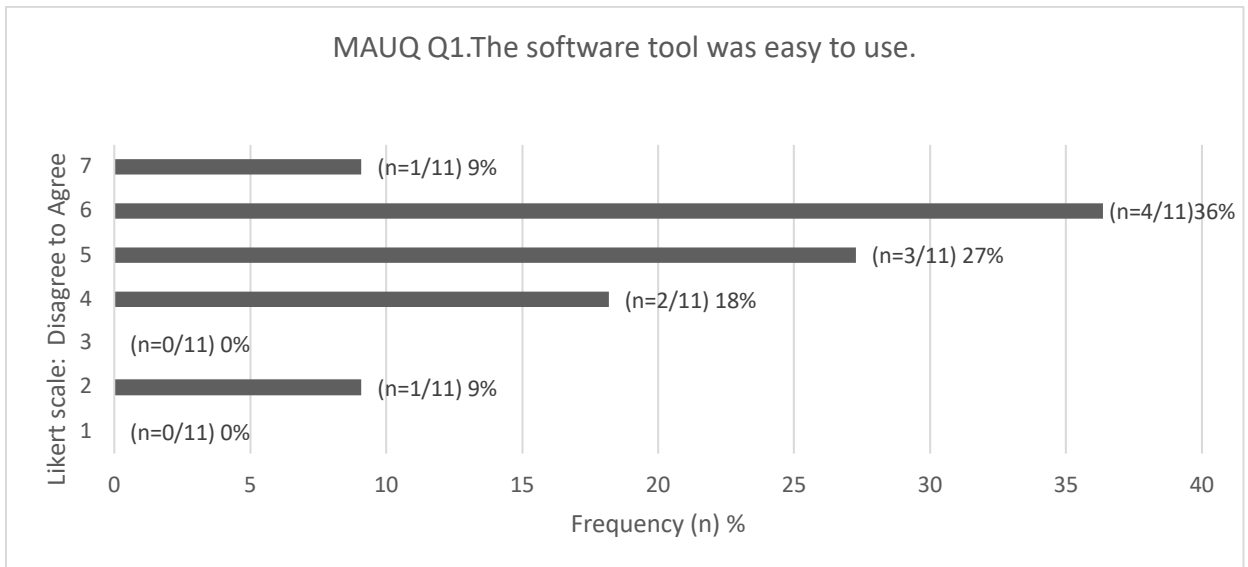


Figure 9.B Ease of use

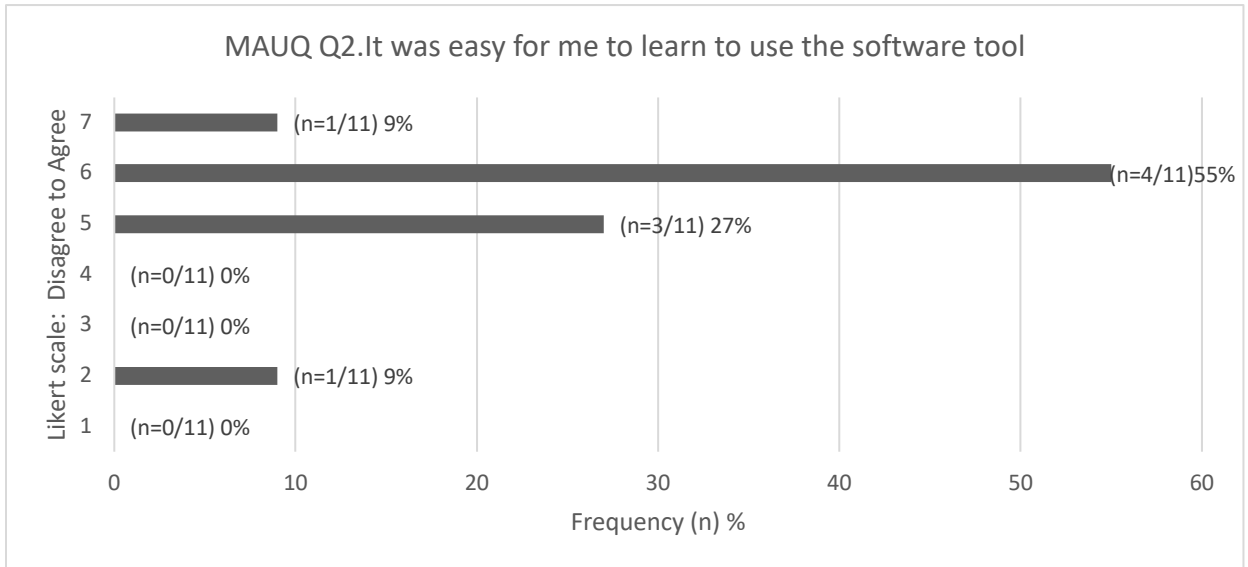


Figure 9.C Ease of use

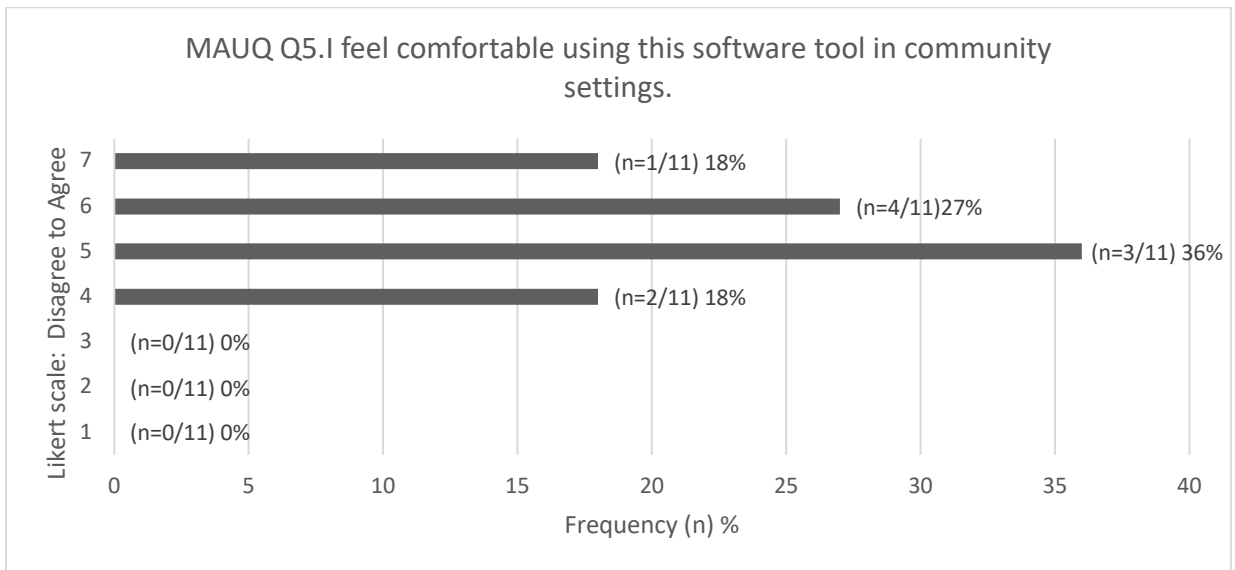
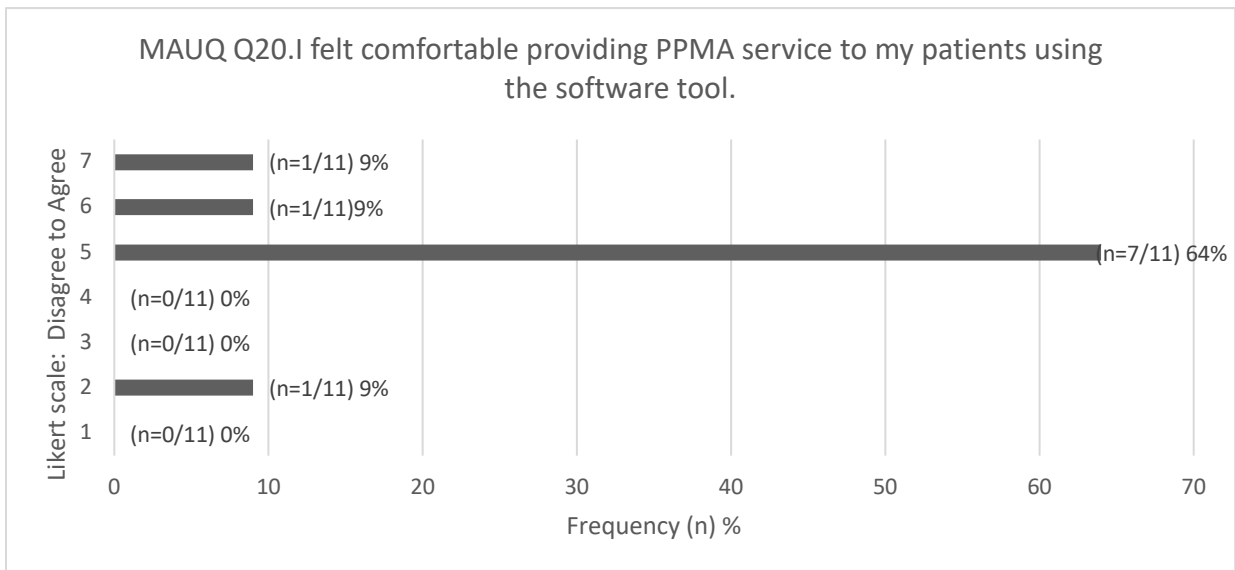


Figure 9.D Ease of use



Effectiveness

The average score for each of the statements from the MAUQ survey which evaluated effectiveness by statement 10, 13, 14, 15, 16, 17,18,19 (Figure 10.A to 10.H) responses was 5.6, 5.5, 5.3, 5.2, 5.4, 5.0, 5.1, 4.9 respectively (refer to Table 2). The range for the average score for each of the respective statements was between 4.9 to 5.6, with overall average of 5.3.

Figure 10.A Effectiveness

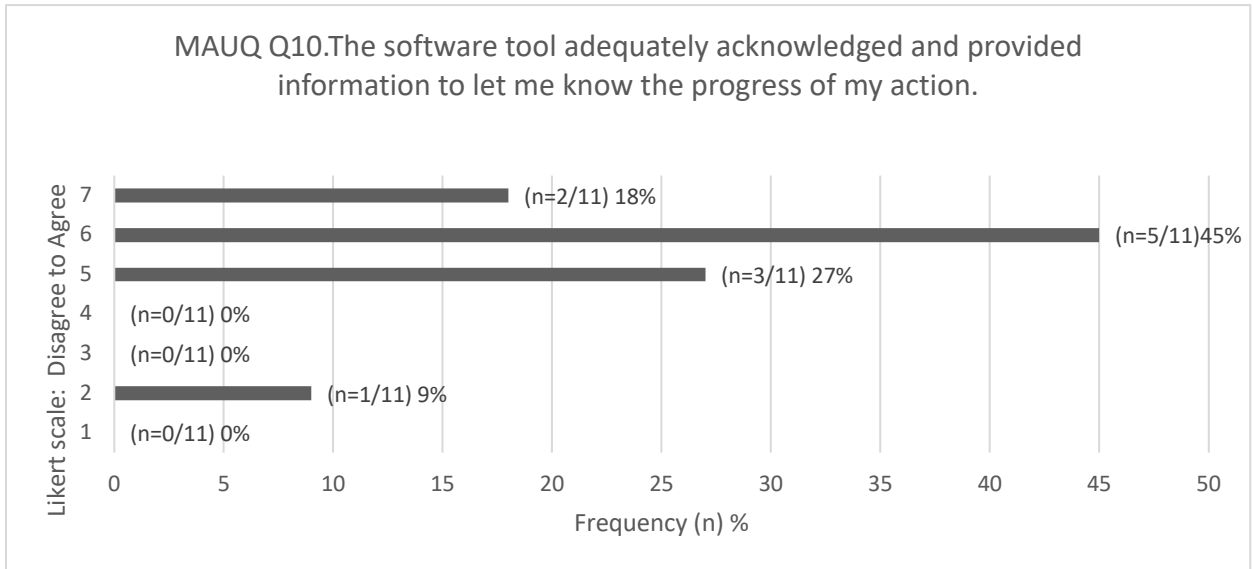


Figure 10.B Effectiveness

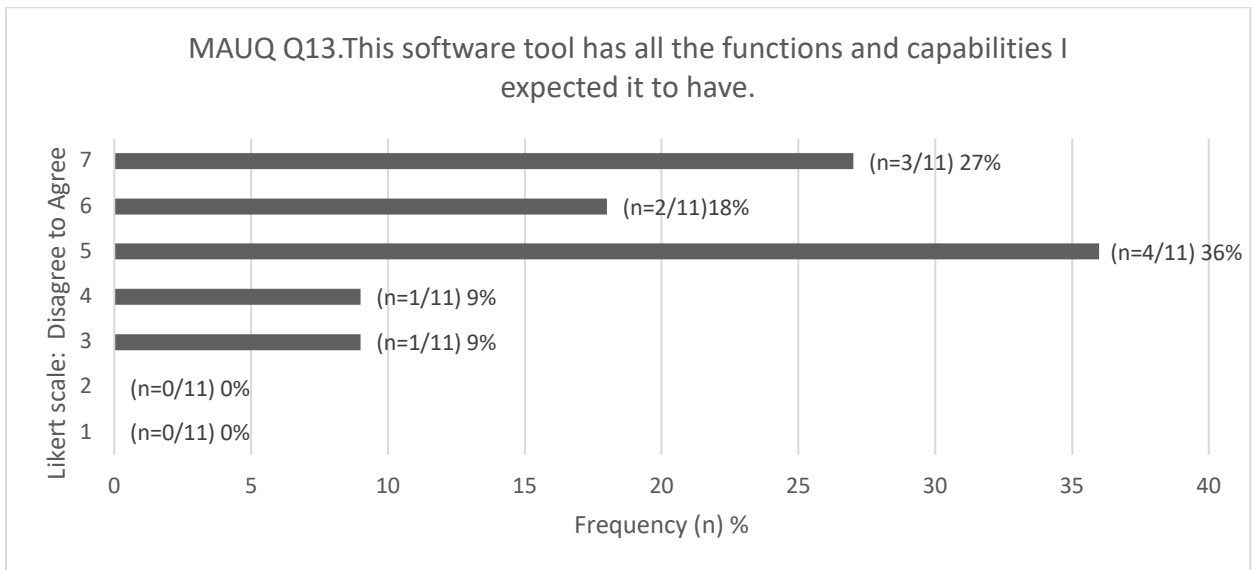


Figure 10.C Effectiveness

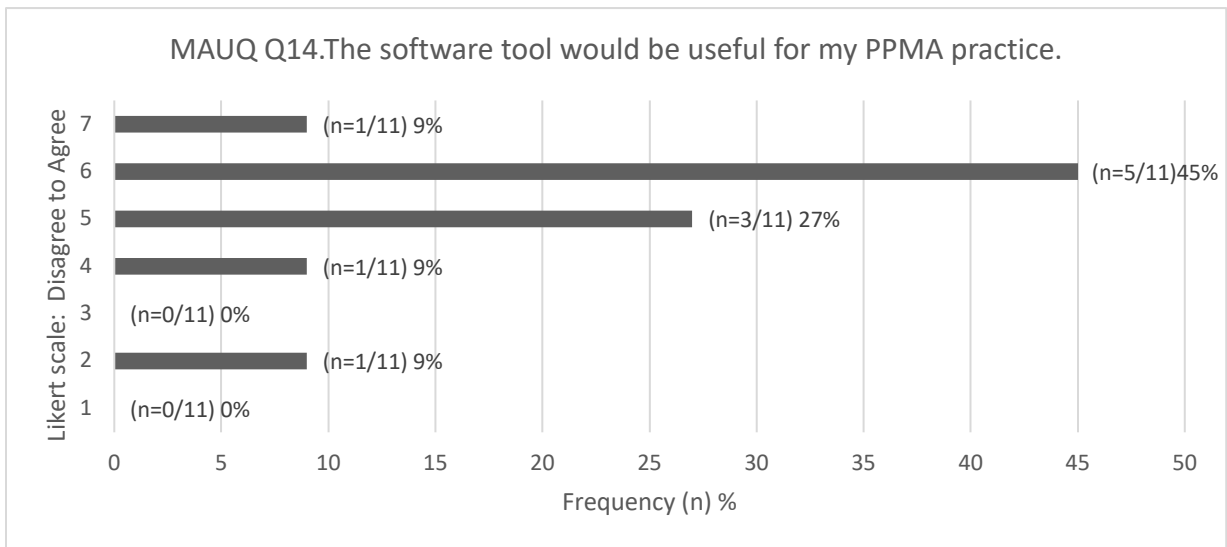


Figure 10.D Effectiveness

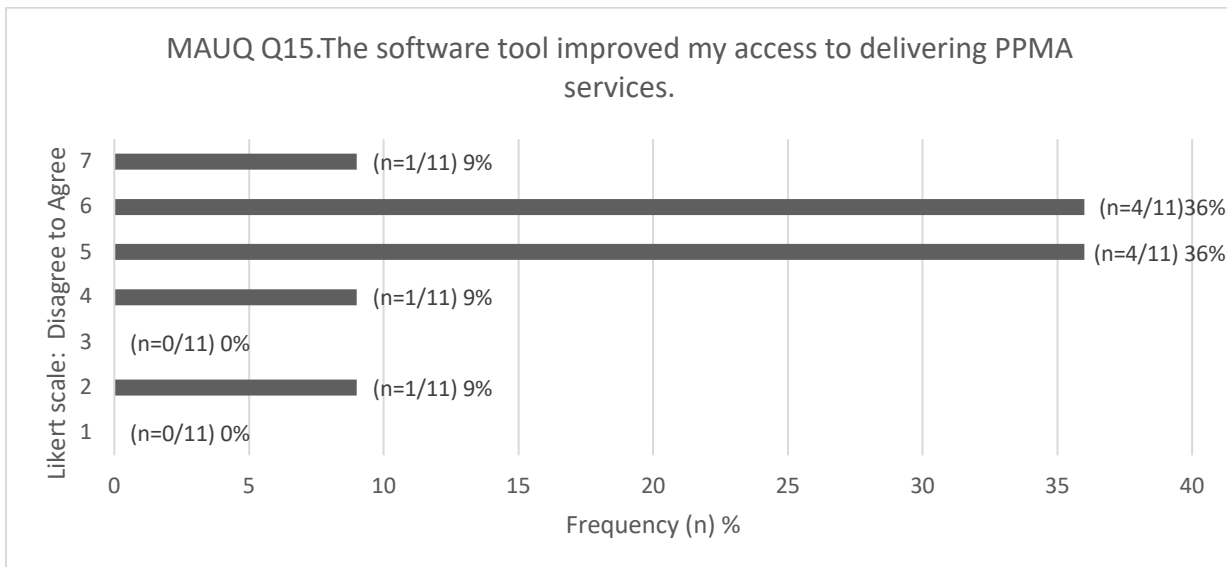


Figure 10.E Effectiveness

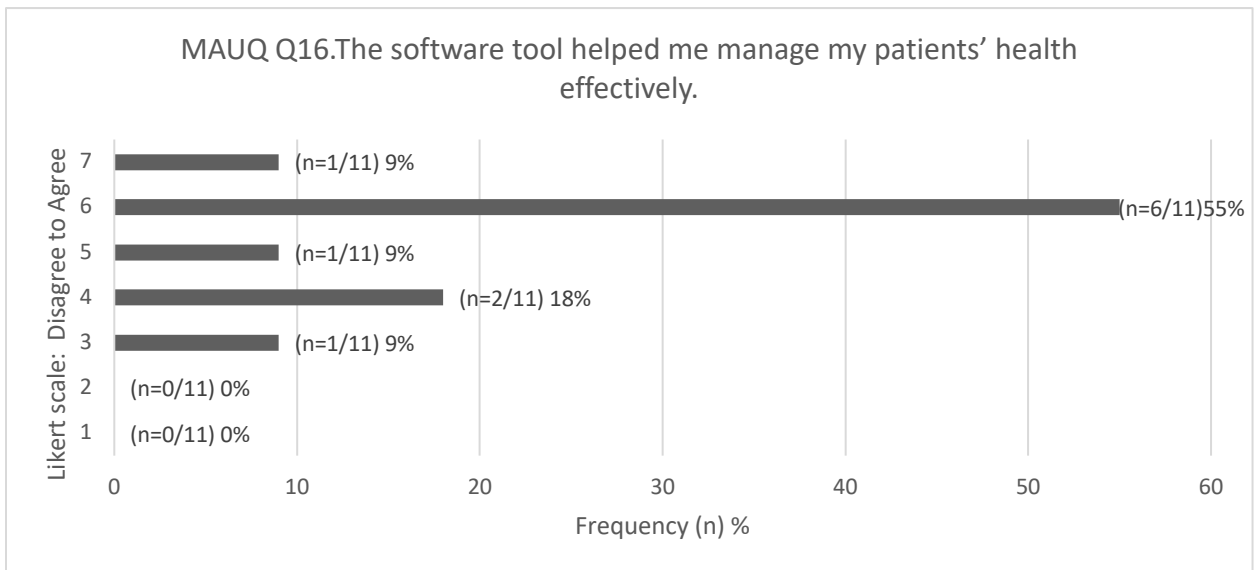


Figure 10.F Effectiveness

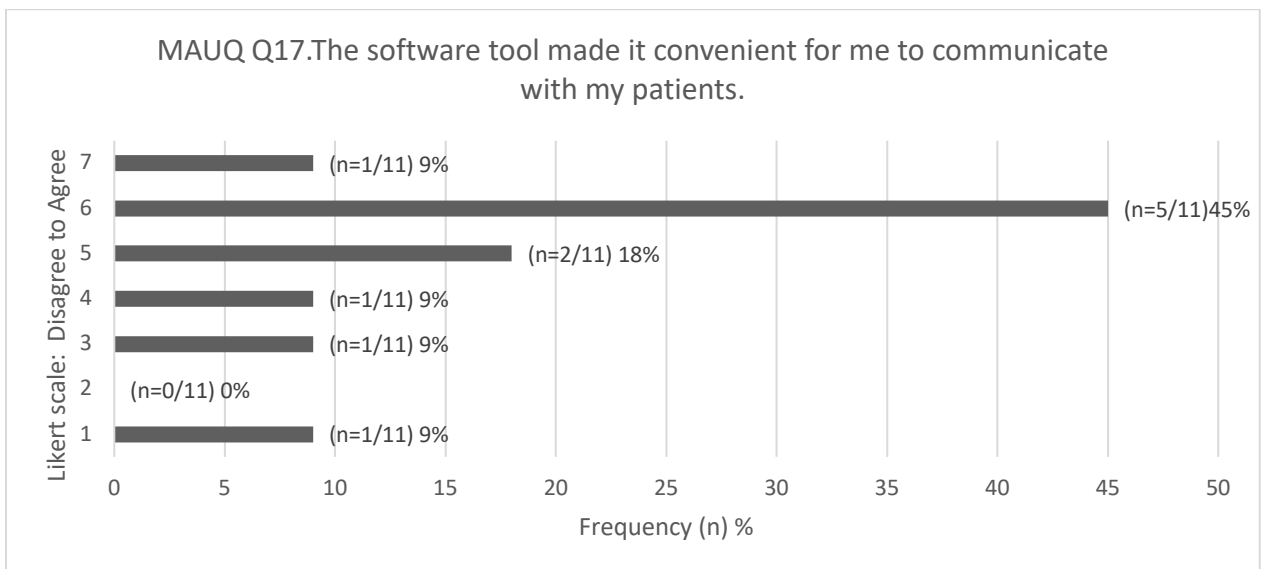


Figure 10.G Effectiveness

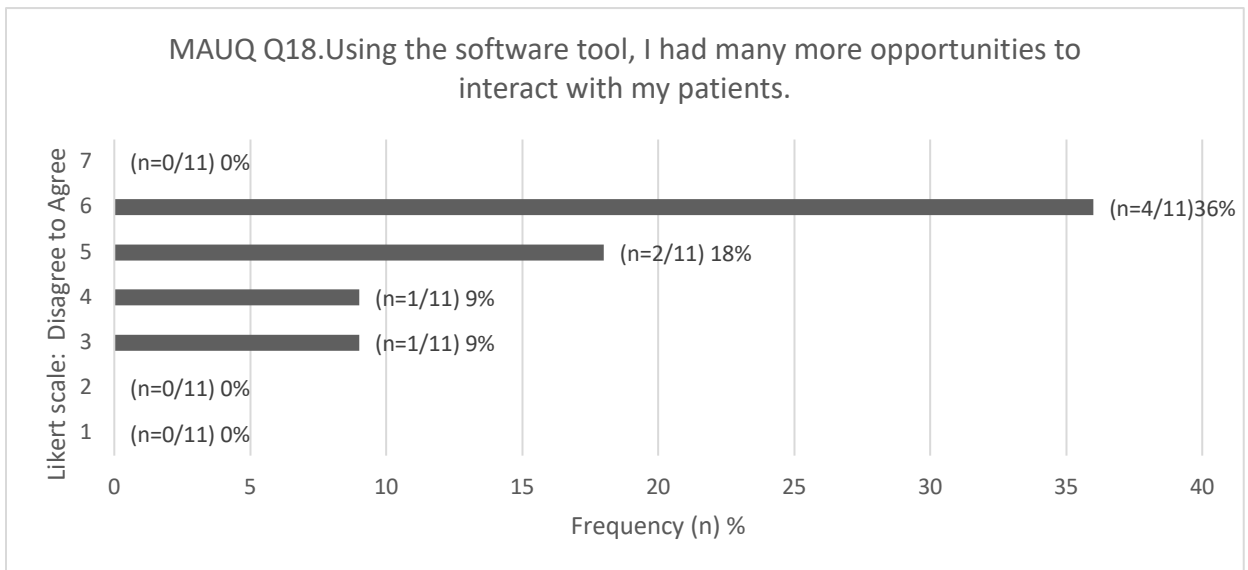
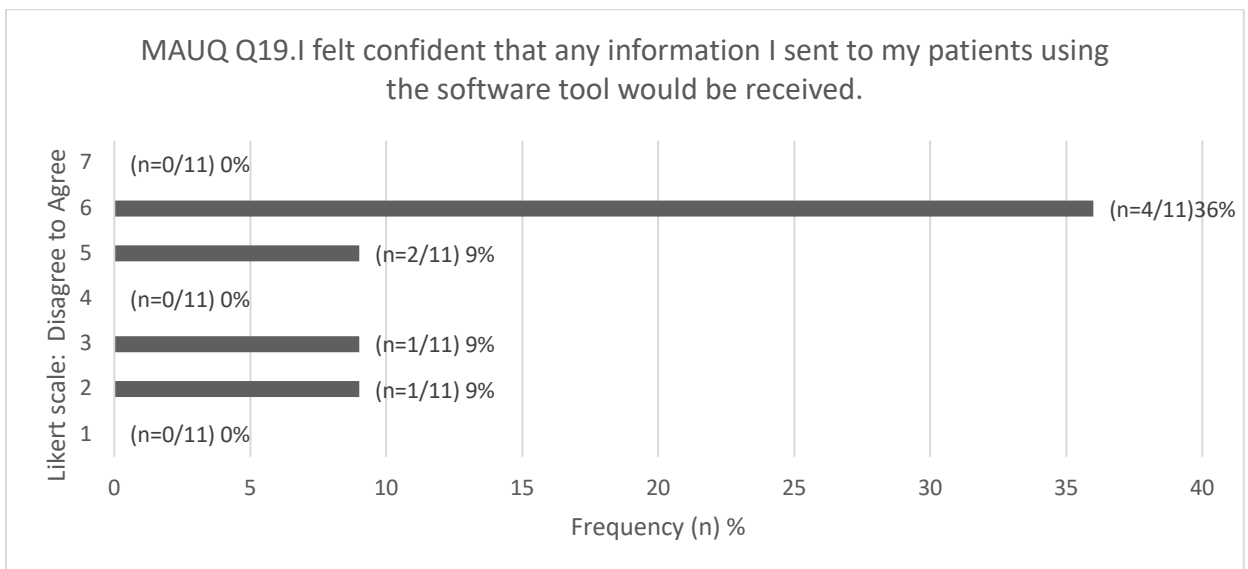


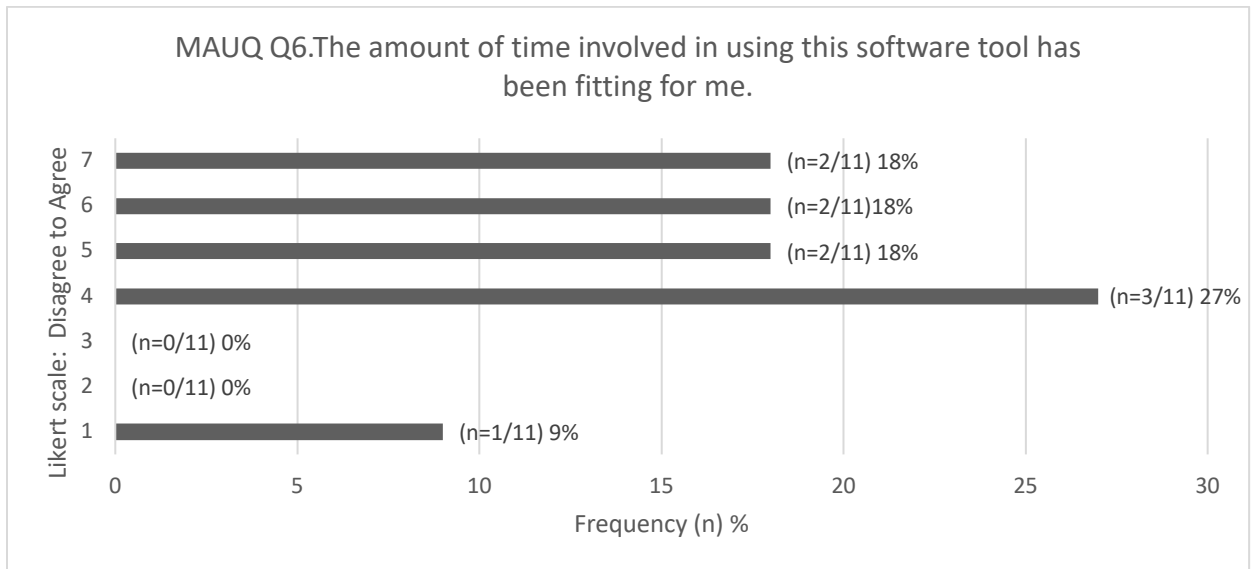
Figure 10.H Effectiveness



Efficiency

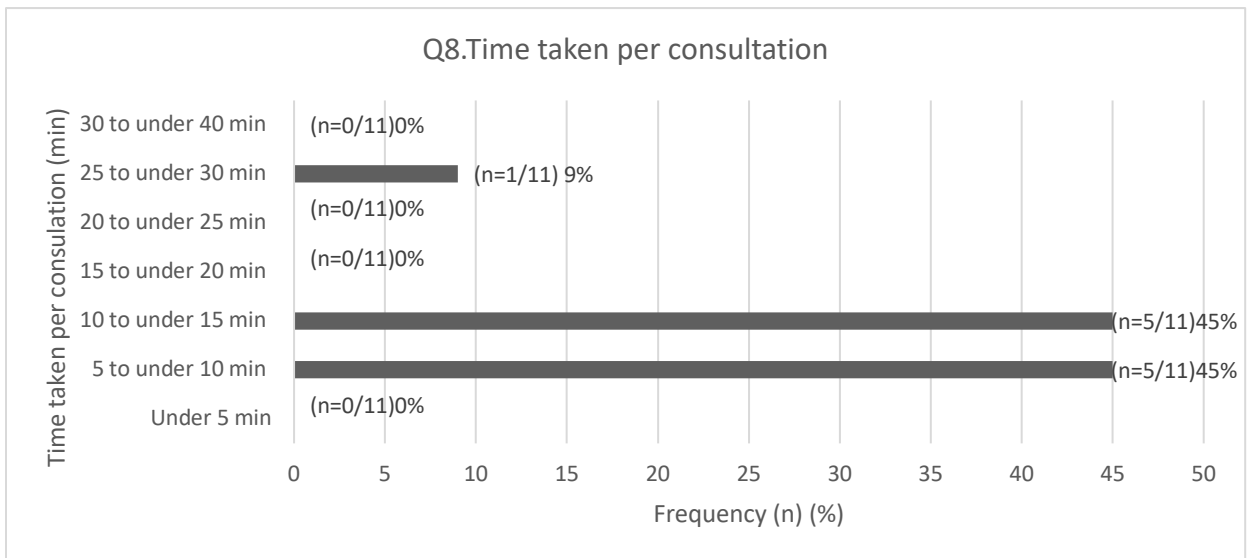
The mean score of the question which evaluated efficiency (Q6) was 4.9/7 for the statement ‘the amount of time involved in using this software tool has been fitting for me.’ This average score aligns with ‘somewhat agree’ response representing a score of 5 indicating participants agreement with the time commitment of using the software to provide MA service. The distribution of responses are shown in Figure 11.A .

Figure 11.A Efficiency



The participants were asked to state the time taken per MA consultation using this software tool. The distribution of responses showed that 45% agreed with the band of ‘5 to under 10 min’ and another 45% agreed with the band of ‘10 to under 15 min’. Therefore, a sum of 90% of the participants agreed that each MA consultation could be completed by minimum 5 to maximum 15 minutes using the software tool (figure 11.B).

Figure 11.B Efficiency



User satisfaction

The factors pertaining to user satisfaction of this software tool, that was evaluated in the survey via following: intuitive user interface statement 3,12 (Figure 12.A, 12.B), software workflow by statement 4,8 (Figure 13.A, 13.B) and easy navigation by statement 11 (Figure 14), respectively. The overall satisfaction was evaluated by statement 21(Figure 15) in the survey. The overall average for the Likert scale responses about user interface questions, software workflow, and navigation was 5.1, 5.6 and 6.2, respectively. The average score for the overall satisfaction was 5.1.

User interface

Figure 12.A User interface

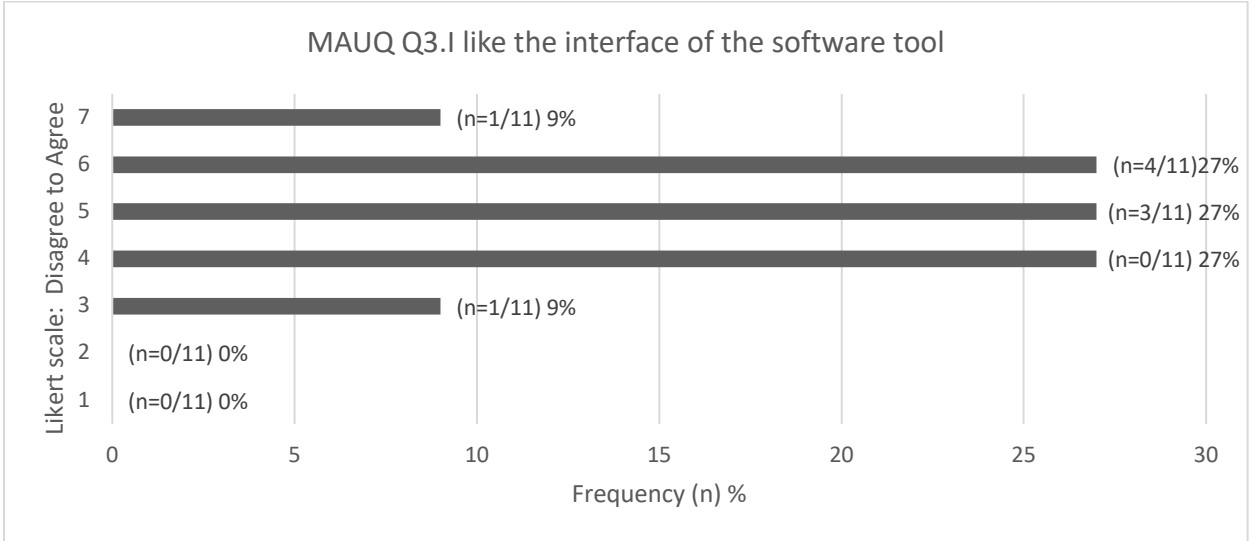


Figure 12.B User interface

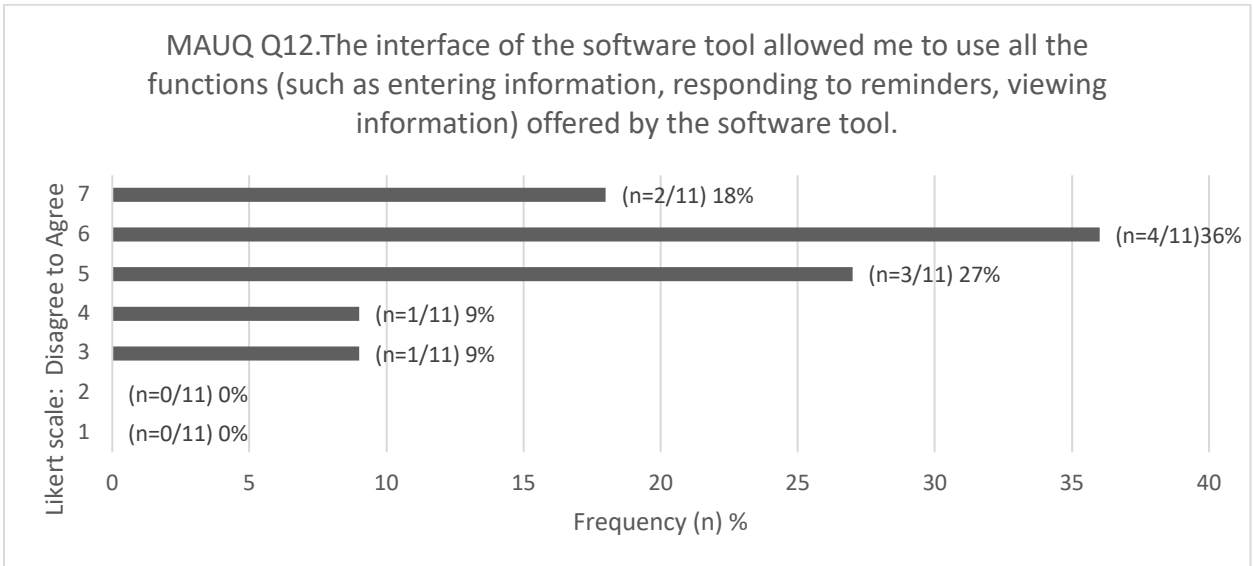


Figure 13.A Software workflow

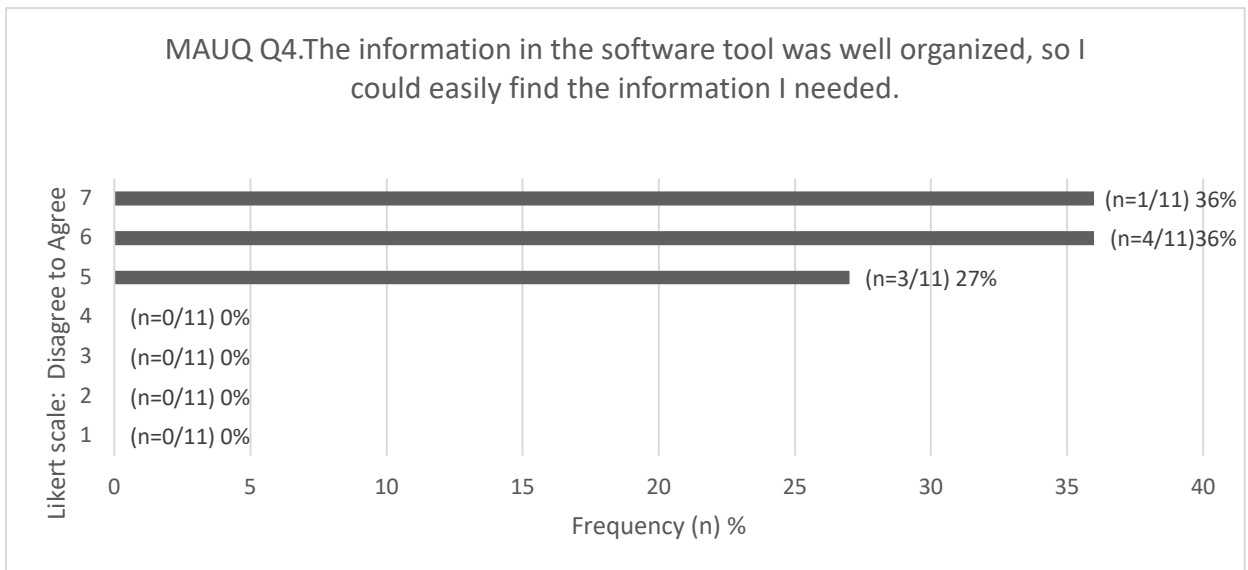
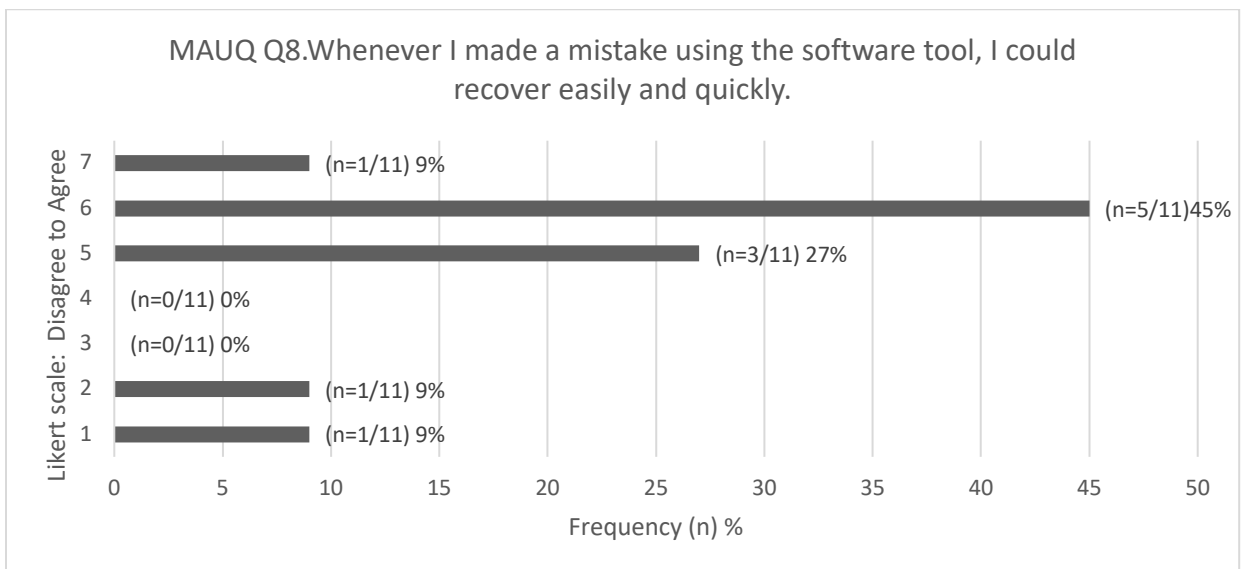
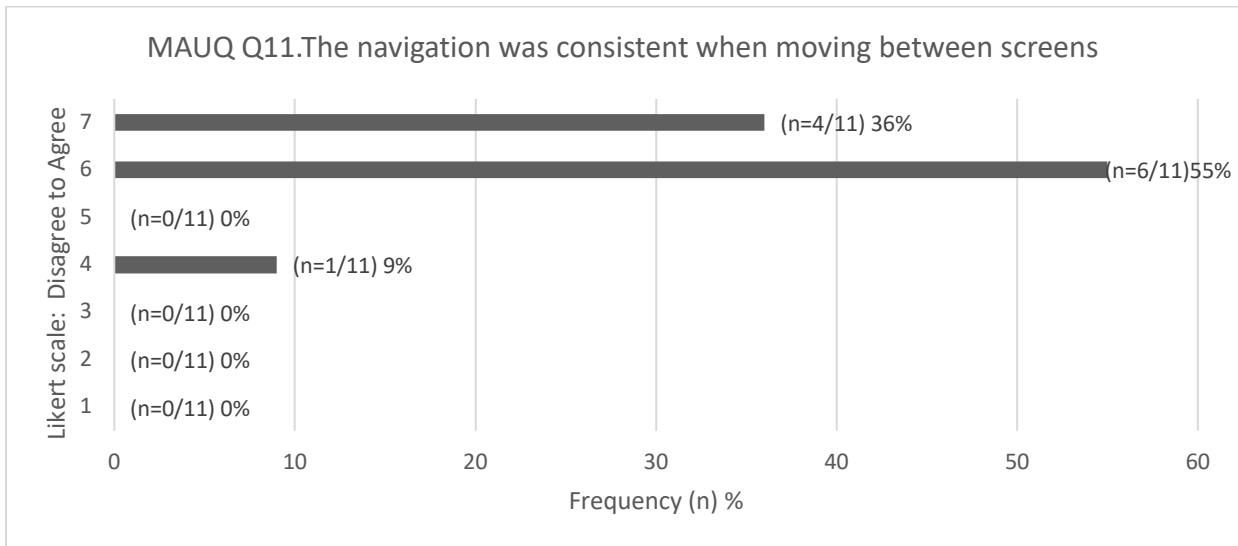


Figure 13.B Software workflow



Navigation

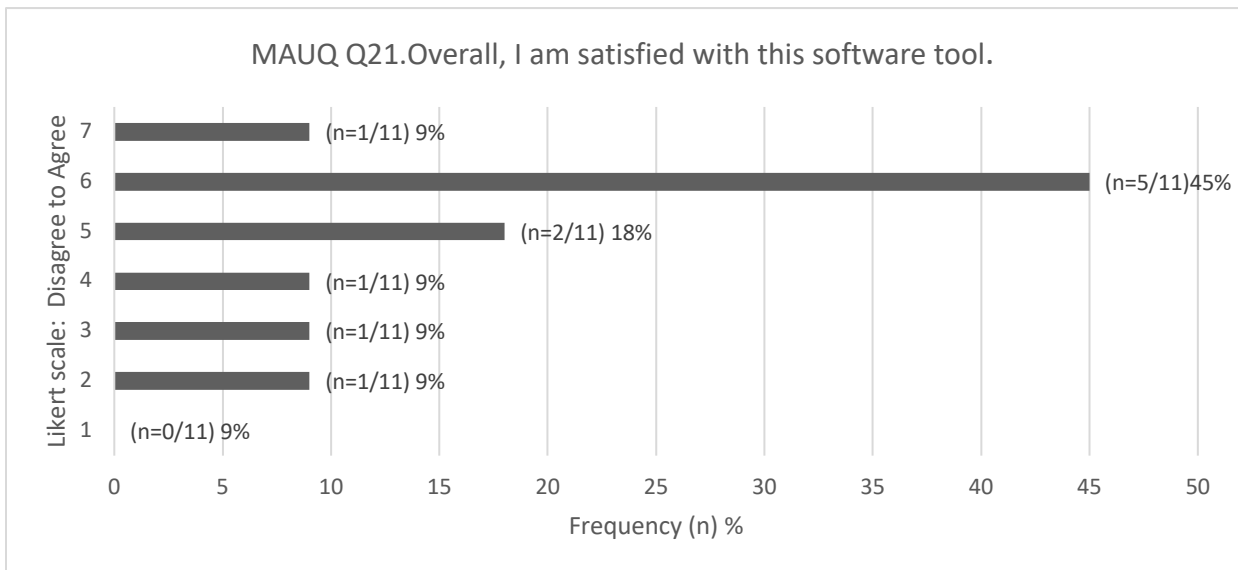
Figure 14 Navigation



Overall satisfaction

The mean score was 5.1/7 for the statement 'overall, I am satisfied with this software tool.' The distribution of responses is shown in Figure 15.

Figure 15 Overall satisfaction



Acceptability

The following questions (statement 7,9) from the survey assessed acceptability of this software tool (Figure 16.A, B). The average Likert scale responses were 5.1 and 5.4 respectively with overall average score of 5.3. The detailed distribution of the responses is stated below.

Figure 16.A Acceptability

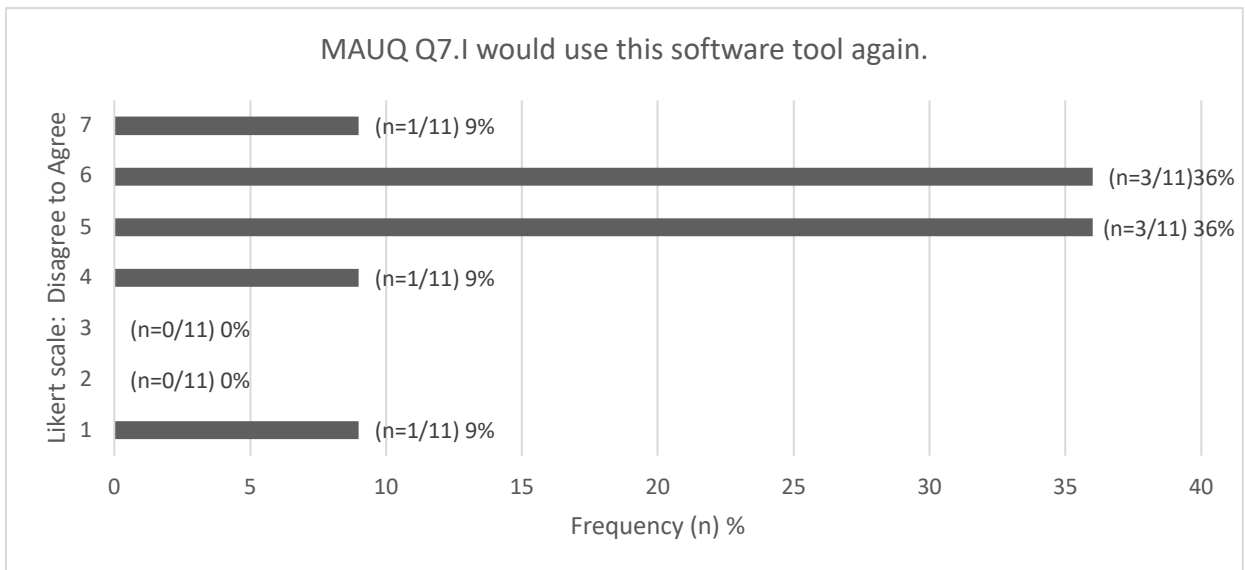
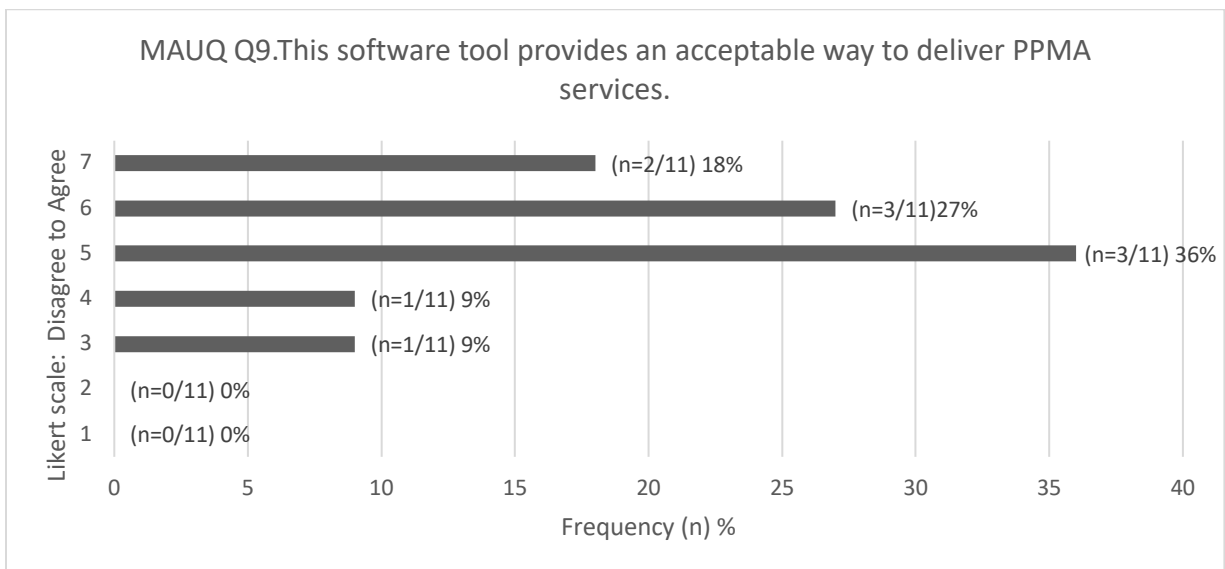


Figure 16.B Acceptability



Acceptability of this software tool was also dependent on two other factors including: potential impact on integration to workflow by Q.10 (Figure 17.A) and overall impact on workload by Q.11

(Figure 17.B). These two factors were also evaluated in the survey and the distribution of the responses has been stated below.

Figure 17.A Impact on workflow

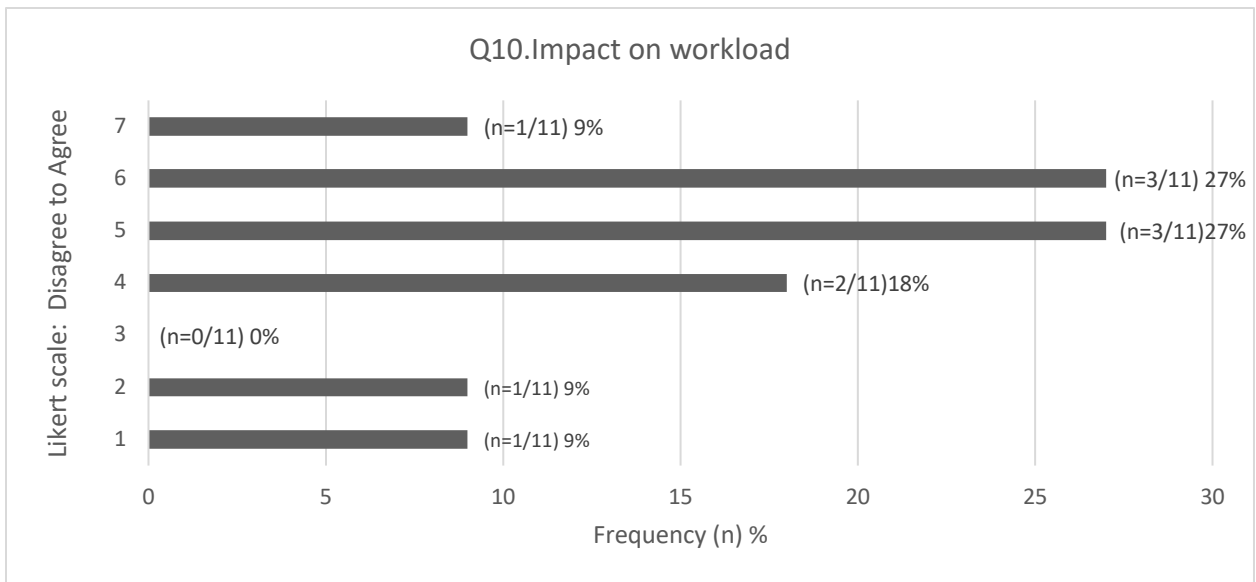
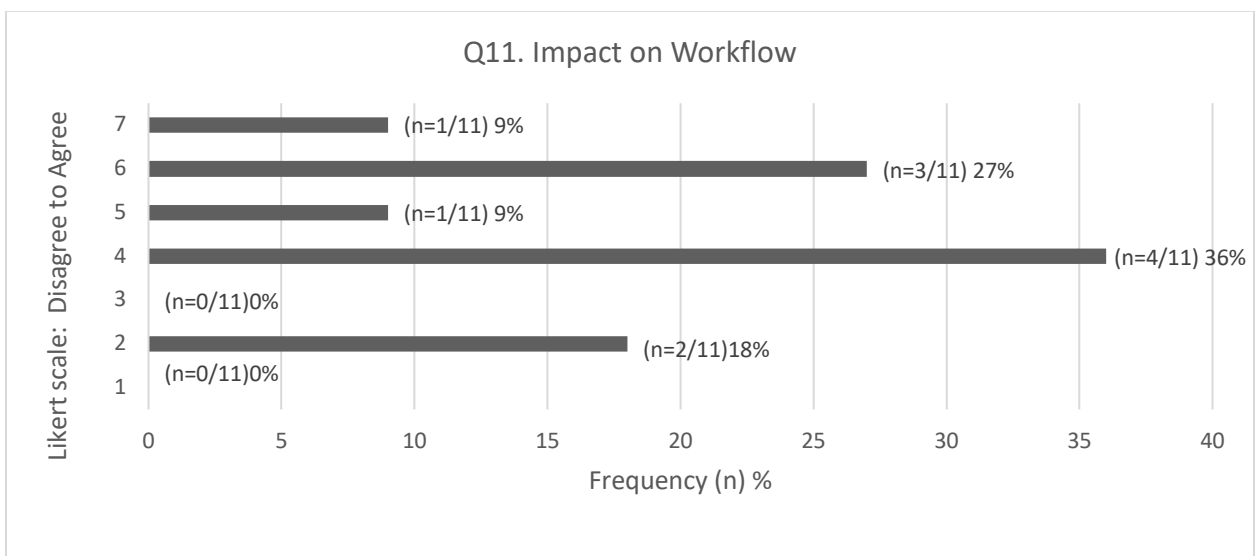


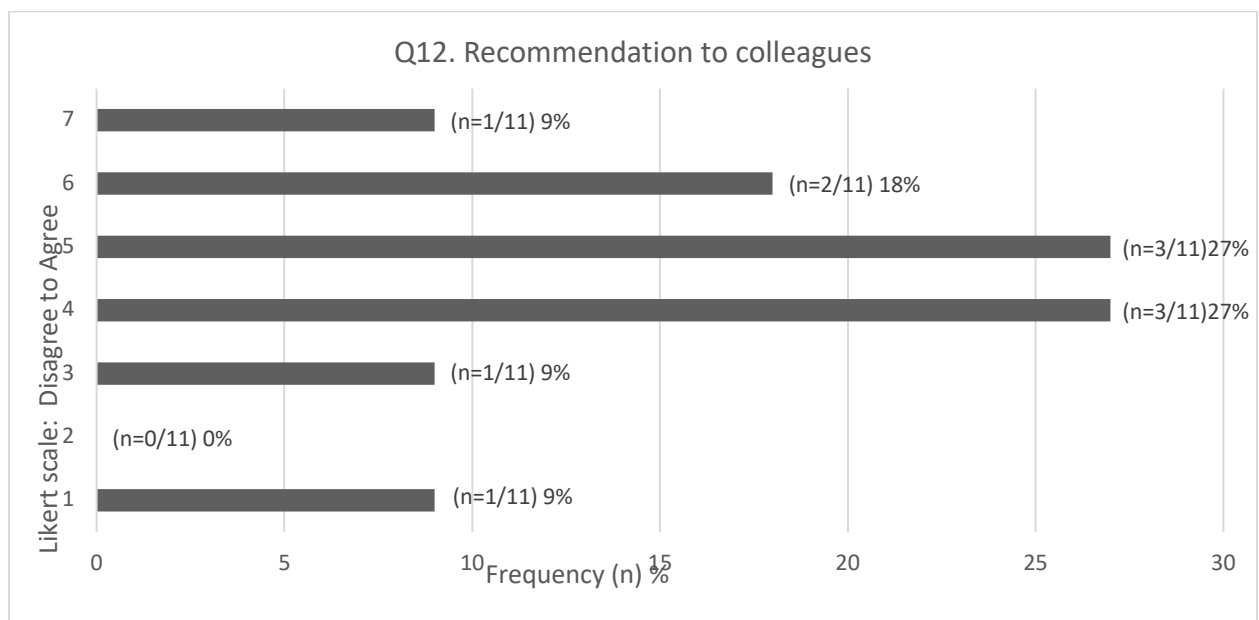
Figure 17.B Impact on workload



45% participants agreed that implementing this software tool for MA prescribing will positively impact the workflow while 36% were neutral and another 18% disagreed with the statement.

Overall, participants perceived the software tool to have good usability, acceptability and commented on the potential impact on workload and workflow, posing good trust in the system. This led to the evaluation of recommendation to colleagues.

Figure 18 Recommendation to colleagues



54% participants agreed that they would like to recommend this software tool for MA prescribing to their fellow colleagues, while 27% were neutral and a total of 18% disagreed with the statement.

3.1.3 Age vs usability scatter plot

This study further investigated the relationship age versus average usability score of each participant in the survey. According to the participants characteristics summarized in Table 1, they all have similar experience and education (factors which can potentially influence person's ability to use technology). However, a variation was observed in terms of the age of the participants. It ranged

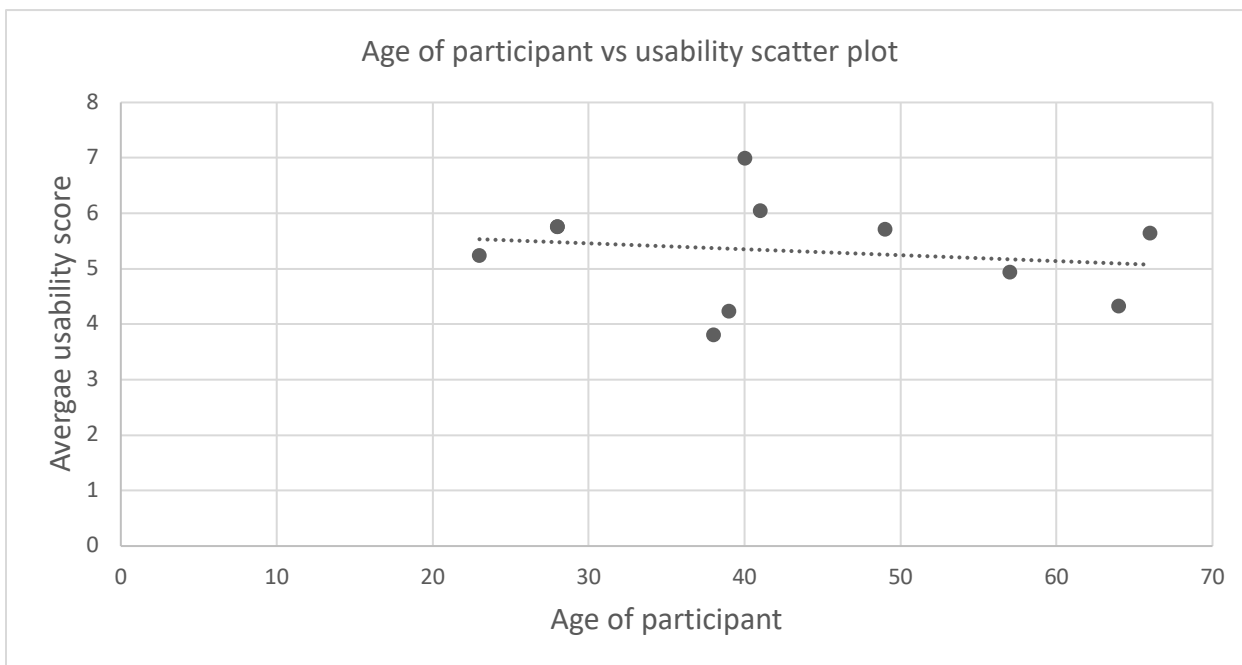
between 20-50 years. This may create a bias in the results since age is thought to affect the use of technology.⁷⁸ Literature suggests that older adults exhibit lower usage rates of technology in comparison to younger adults across various platforms such as computers and web applications.⁷⁸ The impact of age on technology adoption was influenced by cognitive abilities, computer self-efficacy, and computer anxiety.⁷⁸ Therefore, I analyzed if age had an impact on the usability of this software tool.

Thus, age vs usability scatter plot diagram was produced (Figure 19) with age of participant on the x-axis and average usability score on the y-axis. A straight line with no slope on a scatter plot represented a no correlation between the two variables being plotted, but with no association between them. This means that there is no relationship between age and usability of technology, and they are completely independent of each other.

Therefore, even though the study has a small sample size with variation in terms of age (which could ideally affect the response)⁷⁸ but this analysis showed that response was not biased towards any age group. Hence, it can be justified that despite having a small sample size, the results from this study in terms of usability and acceptability may be applicable to the larger population of ON pharmacists practicing in the community pharmacy setting.⁷⁹

This analysis further validated the study despite having a small sample size (N=11).

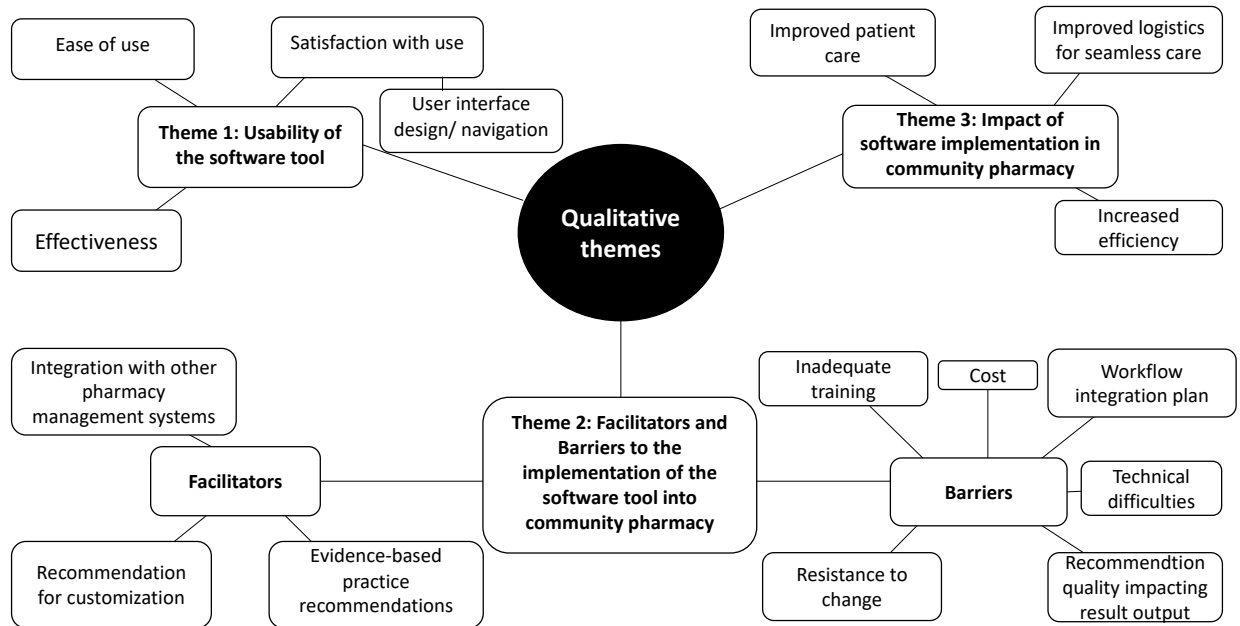
Figure 19 Age vs usability



3.2 Qualitative results

The participants in this study, totaling N=7, were interviewed virtually using online platforms such as Microsoft Teams and Zoom. Interviews were conducted until the point of saturation was achieved, meaning that no new information was being obtained. On average, each interview lasted between 25 to 30 minutes. Participants who had already completed the survey and were additionally interested to provide detailed feedback was selected based on their demographics, for the interview. The 7 participants who were interviewed represented the community pharmacists practicing in the province of Ontario. No repeat interviews were conducted. Three major themes emerged from the interviews. The major themes and sub themes have been summarized in the Figure 20 below.

Figure 20 Qualitative themes and sub themes



3.2.1 Theme 1: Usability of the software tool

The following sub themes identified from the qualitative data were grouped under usability: ease of use, effectiveness, efficiency, and user satisfaction.

Ease of use

Participants acknowledged that the software tool required minimal effort and was not complicated to use. The software tool was also easy to use in terms of actual effort required to completing specific pharmacy tasks in comparison to other pharmacy management software (PMS) regularly used.

“So compared to, say, Medcheck or any of those kinds of systems this [software] was easier to use.”- P2.

“I would rate if it was out of 10 so 0 being no comfort and 10 being very comfortable, I would rate it being probably like a 9 or 10.”-P1.

Participants noted that familiarity with the software further enhanced ease of use.

“I walked through how I did a case [MA patient case study] and what I did. And that was actually the facilitator to us [pharmacy team], doing minor ailments. They [pharmacy team] were like ohh, this is more user friendly than I thought and this actually we can see how it's actually feasible in practice.”- P5.

Effectiveness

The consequence of using the software tool was positive as it helped to improve PPMA service. The software tool proficiently generated accurate prescription that is relevant to the patient’s clinical condition and align with the province specific guidelines, comprehensive summary report, information for physician during referral, to complete the MA prescribing process as per legislative requirements.

“I liked that there was a final report that kind of summarized everything [patient information] that I had inputted for the doctor, so that would get faxed to the circle of care.”-P1.

Satisfaction with use

Participants were satisfied with the overall performance of the software tool. There were two important factors such as intuitive user interface, navigation and efficient workflow which contributed towards satisfaction with use.

Overall satisfaction- “I think it's [the software] highly satisfactory. I didn't feel that there was anything [information] missing. The prescription looked like a standard prescription when it was populated.”-P1.

User Interface- “The way the interface [of this software] looked was very modern and up to date.”-P1.

Navigation- “It was easy to just click the button and then put all your information [patient details] then continue clicking as you [pharmacist] move forward.”-P1.

Workflow- “I found it extremely easy to use everything, just made sense. So, everything was where I expected it to be, and it flowed really well.”-P5.

3.2.2 Theme 2: Facilitators and Barriers to the implementation of the software tool into community pharmacy

3.2.2.1 Facilitators to software tool implementation

Participants have identified several facilitators that can potentially impact the implementation of this software into community setting. These are reported below:

Evidence-based practice recommendations

This software provided evidence-based practice recommendations (following MedSask), ensuring that pharmacists are following the most up-to-date best practices.

“Having MedSask information embedded in there[software] is great and the differential diagnosis piece that's in the front that gives a different description of each one of the differential diagnoses and what to look for and what not.”-P4

Participants have reported that the software was very comprehensive and informative.

“The software gave you a very short cut down of what everything was, what to look for and that was very helpful.”-P4.

The software had all the relevant references available in one place. This saved the inconvenience of scanning through multiple sources to make appropriate decision.

“All the information is available on the one piece of software I don't want to have to have to go to another website or another source or another reference to ensure that I'm doing what I'm doing appropriately for the particular patient having it all there for me? Excellent.”-P4

Integration with other pharmacy management systems

Participants have reported on the necessity of integrating this software tool within pharmacy management system (PMS). PMS integration will allow to fetch patient information, disease, and medication history from the core PMS. This will avoid dual data entry into the systems, prevent error, save time, and provide seamless workflow for pharmacy staff.

“It would be great if that [patients' medical profile] could be completely integrated. You can just import a profile.”-P2.

Recommendation for customization

It was inferred from the data that the software tool will often need customization to meet evolving needs of pharmacy, mainly to add more flexibility and adaptability to the workflow. Participants have suggested the following customizations to ensure sustainable implementation and use of the software tool in the pharmacy. Firstly, participants emphasized on the necessity of a paper-based /offline version of this software tool in case of interrupted internet connectivity. The paper-based version can be useful for patients without access to smart phone/tablet/internet. Additionally, for busy

pharmacy settings, patients can also insert their own information prior to consultation on a hard copy to save their time and facilitate the pharmacy workflow.

“I think we definitely need an offline method [software] because not everyone has Internet and especially if our pharmacy is busy”-P2.

“Having paper documentation just in case as well, because again if our Internet is not working and if we have somebody [patient] then we may want to be able to use it [software] on the paper just in case”-P1.

Secondly, participants suggested on periodical updates of the video tutorials (followed by new customizations/versions of the software). Moreover, pharmacists requested to add detailed MA patient case studies with the tutorial to provide a more pragmatic view of the software.

“I did see some videos on the software to kind of show how to navigate the system, but I believe it might not be updated because when I tried watching one of the videos it doesn't match what I'm seeing. I think the look kind of changed a bit so if we could update that to the newest version, I think that would be very helpful”-P3.

3.2.2.2 Barriers to software tool implementation

While there were several potential benefits of implementing this software tool at community pharmacy setting. There were also several barriers that could potentially impact successful implementation of this software tool. Some of the barriers identified by the pharmacist have been summarized below:

Cost

The software tool implementation was expensive in terms of the robust technical infrastructure, including hardware, software, and network. There were costs associated with the set up and

maintenance of this infrastructure. Moreover, there was a subscription fee associated with the software. Provided this fee was higher than revenue generated through MA consultation alone, this could be a potential barrier to implementation, particularly for smaller pharmacies with limited budgets.

“Pharmacies that are not as profitable or maybe they are worried that maybe they won't get so many people for minor ailment consults. They may wonder about the cost of the of the software.”-P1.

Technical difficulties

Technical difficulties such as system compatibility issues, software bugs and downtime due to poor/loss of internet connectivity or software maintenance could potentially impede implementation.

“I guess the barrier would be pharmacy connectivity issues. So, making sure that the pharmacy has a solid Internet connection and everything like that and they have computers that are working.”-P1.

Participants also reported that the wait time between account registration and access to the software tool has discouraged them with the use. This has also impacted the recruitment of this study thus explain the low response rate. This issue has been described in detail in the ‘Discussion section’ (refer to 4.0)

“I just didn't like to wait a little bit of time in between figuring out what was wrong with the interface when I logged in. I'm just making sure that any of the bugs are fixed. This will help to reduce any like irritation or disappointment.”-P1.

Resistance to change.

Resistance to change was an important barrier to software tool implementation at the pharmacy.

Participants mentioned that their staff or patients could ideally have computer anxiety caused by fear

to learn a new software. Resistance to change of the conventional method could further drive incomprehensibility of the benefits of using this software tool, thus hinder integration to workflow.

“Not a lot of pharmacists that I've worked with are 100% comfortable with computer kind of thing and learning new software.”-P2.

Inadequate training

Adequate training and support for pharmacy staff was essential for the successful implementation of this software tool. Although the software tool was very straight forward yet introductory training/webinar/software walkthrough on how to use the system and ongoing technical support was salient. Otherwise, the software could remain underutilized or not used at all.

“There was a YouTube video in the original e-mail that showed how to do it [use software to prescribe for MA]. So, at first when I looked at it [video tutorial], I was like I don't know where to start, so I actually watched the YouTube video and I found it really helpful.”-P5.

“I think definitely training, having training available would be nice.”-P3.

Recommendation quality impacting result output

This software tool was dependent on the high-quality data to provide accurate prescription. Inaccurate or incomplete data could potentially generate unreliable result. For example, participants have reported that the patient case studies (provided to them during this evaluation study) lacked details which impacted the output.

“If you were looking at a patient where we didn't have any demographic information. You're basically just entering a patient ID. I think it was a just two initials [patient name], that type of thing that went along with it [patient case study provided]. We didn't have any other demographic information. We couldn't really play with the demographic piece at the top.

“We would have liked a little bit more information to be able to maneuver with that demographic piece at the front a little bit how you enter it, why you enter it, what pieces you need to enter. Sometimes it’s more finicky with birth dates and those type of things, depending on how that information is entered.”-P4.

Additionally, participants have stated that the differential diagnosis part of this software tool was lengthy. This may have occurred because more information (from the case studies provided) about the patient was required to rule out other probable condition early in the consultation process.

“I wasn't even sure it was supposed to go to the next step because I was so much into what happened with the differential diagnosis, what to look for, what was missing? I didn't have half the information because of the information [patient case studies] that you gave to us. So, I was not sure that I felt comfortable enough moving to the next step.”-P4.

Workflow integration

A complex challenge identified by participants involved integrating the software tool into existing workflow. It must be integrated into the pharmacy workflow seamlessly to ensure that it does not disrupt existing processes. There must be a proper implementation plan based on the individual needs and resources available at the pharmacy. However, participants have suggested that the entire pharmacy team needs to familiarize with the software tool and that it should be introduced strategically during less busy hours or when additional pharmacist/resources were available.

“We have at least 2 pharmacists. So, one of them does minor ailments, while the other one stays in the dispensary. And we utilize the appointment feature. So that and we have our website where it tells them [patient] where to find link for the minor ailments and that they [patient] will book an appointment. If they come in as a walk-in and there's an appointment available, we've actually set it

up, so we have a store e-mail where the link can be set and an iPad that's just for patients so they can fill in the intake form.”-P5.

3.2.3 Theme 3: Impact of software implementation in community pharmacy

In all environments and places, participants recognized the benefits of using the new software tool compared to the traditional method of manually writing a prescription for MA in a community pharmacy. As a result of utilizing the software tool for MA prescribing purpose, the following effects were observed:

Improved patient care

The clinical software tool helped to improve patient care by reducing medication errors and adverse events. The software has province specific prescribing module (MedSask and following AHFS formulary) built into the algorithm along with prompts that can guide the pharmacist with the prescription and helps them feel more confident MA prescribing.

“Because everything was there at my fingertips already, so it actually made me extremely confident with minor ailments.”-P5.

Increased efficiency

The software tool automatically determined if the condition described by the patient fall into the category of MA, provide list of approved drugs for prescription, or otherwise suggest referral to physician. This saved time per patient consultation.

“You can determine right away if there's red flags. You can see like the medicines that you're allowed to prescribe in the province. You wouldn't be going kind of like off to figure out if you can actually prescribe something[drugs]. You already know what's [drugs] allowed there [province]”- P1.

“Because of this [software], less than ½ hr is needed for each appointment”-P5.

Additionally, the software allowed to add/edit the auto generated prescription. Participants were allowed to add notes for the physician during referral. This ensured prescriber's autonomy.

"It [software] allowed you to still have that clinical decision making, but still reminding you of what you should be doing as well."-P1.

Improved logistics for seamless care

This clinical software tool improved communication between pharmacists, patients, and physicians. Patients could book consultation using the appointment feature of the software at the pharmacy of their choice. Patients could also insert their identification information along with disease specific symptoms into the system remotely, prior to consultation. This saved patient wait time at the pharmacy and ensured that the pharmacist was aware of the patient's condition in advance.

Pharmacists could determine if it was considered as a MA condition and prepared to ask more detailed questions upon real time consultation. Furthermore, the patient follow-up feature (post consultation) that is synced to the pharmacy calendar was very useful. This ensured individual patient follow-up is always up to date and if need be, patients are referred to physicians accordingly.

"Patient calls, we make an appointment. We get them [patient] to fill out the questionnaire or we help them fill it out before they even come into the pharmacy to meet with the pharmacist."-P3.

"The patient follow-up appointments afterwards were useful. The follow up is sometimes difficult to do in pharmacy, but if the paperwork is there and synchronized with a calendar that helps."-P2.

Overall, the successful implementation of software in pharmacy required careful consideration of both the potential barriers and facilitators. Addressing the barriers and leveraging the facilitators can help to ensure that software is effectively implemented and integrated into pharmacy practice.

Chapter 4

Fourth chapter

4.0 Discussion

The objective of this study was to assess the feasibility of implementing an innovative software tool that can facilitate to prescribe for MA pharmacists. This evaluation investigated the software tool's usability, acceptability, potential impact on workload and workflow from the pharmacist's perspective. A mixed method design was used, involving a quantitative survey followed by semi-structured interview. The results showed that most (72%) of participants agreed that this software tool was usable, 81% agreed that it is acceptable, 63% agreed on a positive potential impact on workload, and 45% agreed on positive impact of workflow. Overall, 90% of participants stated that the average time per consultation using the software tool ranged between 5 to 15 minutes. Results obtained from the qualitative data described the ease and effectiveness of using the software tool in practice. The consequence of using the software tool was positive as it automated diagnostics, pharmacological and non-pharmacological recommendations, monitoring parameters and medical information. This saved time and facilitated the clinical decision making for MA prescription.

Recognizing various factors that influence successful implementation can be useful to expand the reach of evidence-based interventions such as CDSS. The implementation of the CDSS for MA prescribing software tool, explored in this study, presents a way to engage community pharmacists in public health initiatives related to MA service delivery without adding further burden to their existing workload. The introduction of the MA service into the pharmacist's responsibilities has been positively received. In fact, over 2400 pharmacies in Ontario's have already begun providing this service since the start of the year 2023, and it is anticipated that more will join in the near future.⁸⁰

Previous studies have demonstrated that CDSS can have various beneficial outcomes in the context of

community pharmacy, such as expanding clinical opportunities, easing workload burdens, and streamlining technical tasks.^{54-57,81} This study adds to the literature by demonstrating the necessary characteristics for successful implementation of an important tool for MA management by pharmacists.

This study found that usability of CDSS is a very important factor which ultimately drives the uptake and use of a new software in practice. The integration of CDSS with other healthcare software systems is an important characteristic because literature suggests that like CPOE systems that are designed and integrated into hospital computer system or CDSS in primary care, likewise CDSS in community pharmacy should also be integrated with the PPMS.^{39,40} Since usability is a multifactorial component, it was evaluated based on the following factors i.e., ease of use, effectiveness, efficiency, and user satisfaction. The results obtained from the quantitative survey indicated that pharmacists agreed that the software tool was easy and comfortable to use. The software tool was effective and had good functionality congruent to the time commitment involved in using it to prescribe for MA. Using the TAM framework (i.e., perceived ease of use; perceived usefulness) this software has several characteristics driving user intention towards adopting a new technology.⁶⁷ The simplicity and workload reduction provided by the software tool were highly valued by the pharmacists, emphasizing the significance of replicating these qualities in similar interventions to enhance the likelihood of successful implementation. Another important factor determining the success of CDSS implementation is 'acceptability'. The quantitative results indicated high willingness among pharmacists to use this software tool for MA service. The corresponding qualitative results state that pharmacists were satisfied with the overall performance of this software tool and that it produced satisfactory result during MA consultation practice.

Although this software tool has good acceptability, yet there were challenges noted during the integration into workflow. Although the software had intuitive user interface and easy navigation, yet pharmacists suggested to add prompts specifying missing field of information. This can ideally save time during consultation. The pharmacists further suggested an integrated version of this software tool which could ideally pull patient information from the PPMS thus save time over duplicate data entry. However, pharmacists strongly emphasized on the need for an alternative plan such as paper-based version of the software tool to prevent discontinuation of work during technical challenges or network downtime. Thus, accountability of these above-mentioned factors could facilitate with workflow and allow smooth integration. This was reflected in the quantitative data obtained from the survey where although 45% participants agreed that implementation of this software tool for MA prescribing will positively impact the workflow, 36% were neutral and the remaining were indifferent about it. Ergo, proper implementation plan is needed to incorporate this already ‘accepted’ software tool into practice.⁸² An implementation plan can ideally include introductory training, tech support, adequate resources at workplace and strategic plan (factors suggested by pharmacist in the qualitative data) to integrate the software tool into pharmacy workflow.

Pharmacists’ have also reported two other major barriers that included technical difficulties such as system compatibility issues, software downtime or internet connectivity issues, post implementation and resistance to change among potential users due to computer anxiety (albeit age does not affect usability). In terms of potential solution, pharmacists suggested using a paper-based version of the software tool, having an offline mode (i.e., a feature that will allow pharmacist to access the software without internet connection) or a ‘lite’ version (i.e., a version of the software tool with limited or basic functionality for slower internet connection) as an alternative to manage patients during technical difficulties (this was highlighted in qualitative data). On the other hand ‘change’ can be

addressed with organizational support such as leadership procedures and resources.⁸³ Hence, when developing new CDSS aimed at community pharmacy services, pharmacists have identified these themes as significant for ensuring successful implementation and continued use. As the responsibilities of pharmacists continue to grow and new clinical services emerge, these findings will aid in guiding the design and customization of new CDSS, as well as effective implementation strategies.⁸³

Pharmacists have also identified several facilitators in this study such as being established on evidence-based practice recommendations to guide clinical decision, scope for customization of the software tool according to practice needs but most importantly integration of the software tool with other pharmacy software (i.e., PPMS). Firstly, as the clinical practice recommendations always continue to change according to the provincial guidelines⁷ for e.g., from Fall 2023, six more ailments will be added to the list of thirteen MA conditions approved in ON.⁸⁴ It is beneficial to have CDSS that will update these changes periodically following evolving scope of practice.⁸⁵ In addition, by continuous updates, most recent clinical guidelines are provided to pharmacists to offer the most optimal care to patients. This will further enhance evidence-based practice and aplomb pharmacist with up-to-date information.^{85,86} Secondly, this integration will allow to fetch patient information, disease, and medication history from the core PMS. This will avoid dual data entry into the systems, prevent errors, save time, and provide seamless workflow for pharmacy staff. This will eventually save time, reduce overall workload and allow successful integration into workflow.³⁹ As such, successful implementation of CCDS requires the seamless integration with pharmacy software.^{39,85} Thus, software companies should consider this factor as a key enhancer while designing CDSS.³⁹

4.1 Strengths and limitations

I performed an evaluation of an innovative software to support pharmacists' newly introduced clinical practice for MA. This study has several strengths, First, it was guided by a theoretical framework (the TAM), which allowed me to guide the study design, data collection materials as well as result interpretation. This way, all the aspects of *feasibility* was evenly evaluated. Secondly, the sample was diverse in terms of the demographics and representative of ON pharmacists. Thirdly, simple case studies were designed to be simulating real patients with MA conditions.

However, several limitations should be considered of this study: First, this study had a small sample size due to significant challenges encountered during the recruitment phase. The small sample size for the quantitative section resulted in having low statistical power. The initial response rate for study participation was very low. This could be due to the following reasons: 1) Timing of the study: this study was launched almost concurrently following the legislative authorization allowing pharmacists in ON to prescribe for MA. Early on this phase, pharmacists may be occupied constructing their ethical, legal, and professional obligations of PPMA within their work environment (particularly scope of practice regulatory change and completion of mandatory orientation MA prescribing module). Previous research has shown that the uptake of pharmacists of MA prescribing happens over several years.⁸⁷ Therefore, it was difficult to recruit participants during this stage. 2) Pharmacist workload fatigue: pharmacists were busy dealing with COVID-19 pandemic (i.e., vaccination, testing, managing chronic diseases through prescription extension and other clinical services)⁸⁸ and had very little time left to participate in a research study, 3) Strict eligibility criteria: we only included community pharmacists, but several pharmacists did not meet the criteria for minimum hours of practice per week (i.e., 8 hours) or did not complete all 5/5 patient case studies using the software tool. However, these eligibility criteria were necessary for the purpose of familiarity and applicability

to the context of this study, 4) Multi-step registration and study process: there were multiple steps involved with the registration process. It was mandatory for the participants to complete each sequential step to complete participation. This may have led to the loss of participants. The above-mentioned challenges were tackled by re-strategizing the recruitment policies. Firstly, 2 individual interactive webinar sessions were conducted with the ON pharmacists to provide an overview of MA prescribing scenario and inform them about this evaluation study. This interactive session allowed participants to ask questions about the new MA service and this study. Secondly, the study protocol was revised for ethics amendment to include pharmacy interns who could also provide insightful user feedback about the software tool. Also, the current client base of the software company was also approached to gain valuable feedback. Thirdly, the multiple steps involved in the account registration process was reduced to a single step by creating bulk registration accounts (this task was executed by PharmAssess). This way, the participants could directly access their accounts without any delay or confusion. Regardless, the response rate was still low. Therefore, possible solution to increase participant engagement could be future studies with considerable incentives to account for time constraints.

Second, although data saturation was achieved during the semi-structured interviews, it is possible that other pharmacists' views could have appeared eventually with more interviewing. Also, pharmacists did not get full experience of the software tool due to lack of access to actual patients presenting with MA conditions at the pharmacy and provided their perspective depending on the case studies. However, pharmacists in ON did not receive authorization to prescribe for MA until later time during the study period.

4.2 Future directions

The interpretation of the evidence collected from survey and interviews suggest that all factors pertaining to usability, acceptability and potential impact of integration must be considered for adding MA into practice and improve patient care. Future studies should examine how to overcome these barriers for successful implementation and use of this MA prescribing software tool.

4.3 Conclusion

This research provides valuable findings on the contextual elements linked to the initial implementation of a CDSS software tool in community pharmacies. The aim is to empower pharmacists to prescribe for MA. According to community pharmacists, the implementation of this software tool was seen as feasible, meaning it was usable, acceptable, and had the potential to positively impact workload and pharmacy workflow. The findings of this study may be used to customize this software tool for similar future interventions in the community pharmacy setting.

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Appendix A

The comparison in pharmacists' scope of practice in Canadian provinces

PHARMACISTS' SCOPE OF PRACTICE IN CANADA

 Implemented in jurisdiction
  Pending legislation, regulation or policy for implementation
  Not implemented

		BC	AB	SK	MB	ON	QC	NB	NS	PEI	NL	YT	NWT	NU
Prescriptive Authority (Schedule 1 Drugs) ¹	Independently, for any Schedule 1 drug	X	✓ ⁵	X	X	X	X	X	X	X	X	X	X	X
	In a collaborative practice setting/agreement	X	✓ ⁵	✓ ⁵	✓ ⁵	X	X	✓	✓	X	X	X	X	X
	Initiate ²													
	For minor ailments/conditions	X	✓	✓	✓ ⁵	P	✓	✓	✓	✓ ⁵	✓	X	X	X
	For smoking/tobacco cessation	X	✓	✓	✓ ⁵	✓	✓	✓	✓	✓ ⁵	✓	X	X	X
In an emergency	✓ ⁷	✓	✓ ⁷	✓ ⁸	✓	✓	✓	✓	✓	✓ ⁷	X	X	X	
Adapt ³ /Manage	Independently, for any Schedule 1 drug ⁴	X	✓ ⁵	X	X	X	X	X	X	X	X	X	X	X
	Independently, in a collaborative practice ⁴	X	✓ ⁵	✓ ⁵	✓ ⁵	X	X	✓	✓	X	X	X	X	X
	Make therapeutic substitution	✓	✓	✓ ⁹	X	X	✓ ¹⁰	✓	✓	✓	✓	✓	X	X
	Change drug dosage, formulation, regimen, etc.	✓	✓	✓ ⁹	✓	✓	✓	✓	✓	✓	✓	✓	X	X
	Renew/extend prescription for continuity of care	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X
Injection Authority (SC or IM) ^{1,5}	Any drug or vaccine	P	✓	✓	✓	X ¹¹	✓	✓	✓	✓	✓	✓	X	X
	Vaccines ⁶	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X
	Influenza vaccine	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X
Labs	Order and interpret lab tests	X	✓	P ¹²	✓ ¹³	X	✓	P	P ¹²	✓ ¹⁴	X	X	X	X
Techs	Regulated pharmacy technicians	✓	✓	✓	✓ ¹⁵	✓	X	✓	✓	✓	✓	X	X	X

- Scope of activities, regulations, training requirements and/or limitations differ between jurisdictions. Please refer to the pharmacy regulatory authorities for details.
- Initiate new prescription drug therapy, not including drugs covered under the *Controlled Drugs and Substances Act*.
- Alter another prescriber's original/existing/current prescription for drug therapy.
- Pharmacists independently manage Schedule 1 drug therapy under their own authority, unrestricted by existing/initial prescription(s), drug type, condition, etc.
- Applies only to pharmacists with additional training, certification and/or authorisation through their regulatory authority.
- Authority to inject may not be inclusive of all vaccines in this category. Please refer to the jurisdictional regulations.
- Applies only to existing prescriptions, i.e., to provide continuity of care.
- Pursuant to a Ministerial Order during a public health emergency.
- Applies only to pharmacists working under collaborative practice agreements.
- Only in the case of a drug shortage.
- For education/demonstration purposes only.
- Pending health system regulations for pharmacist requisitions to labs.
- Authority is limited to ordering lab tests.
- Authority limited to ordering blood tests. No authority to interpret tests.
- Pharmacy technician registration available through the regulatory authority (no official licensing).

Appendix B

Conditions authorized for Pharmacist Prescribing under Minor Ailment Program

Table 1. Conditions authorized for pharmacist prescribing under minor ailment programs in Canada.

Conditions ☒	Alberta *	Manitoba	New Brunswick	Newfoundland and Labrador	Nova Scotia	Prince Edward Island	Quebec	Saskatchewan	Ontario **
Acne vulgaris ^a	X	X	X	X	X	X	X	X	
Acute mountain sickness prevention	X						X		
Allergic conjunctivitis	X						X	X	X
Allergic rhinitis	X	X	X	X	X	X	X	X	X
Atopic dermatitis (eczema) ^b	X	X	X	X	X	X	X	X	X
Bacterial conjunctivitis	X						X	X	X
Calluses and corns	X	X ¹	X	X	X	X			
Contraception (hormonal)	X	X ¹			X ³		X	X	
Contact allergic dermatitis ^c	X	X	X	X	X	X	X		X
Cough	X	X	X	X	X	X	X		
Candidal stomatitis (oral thrush) ^d	X	X	X	X	X	X	X	X	X
Dandruff	X						X		
Diaper rash/dermatitis, irritant and candidal	X						X	X	
Diarrhea (noninfectious)	X		X	X	X	X			
Dysmenorrhea ^e	X	X ¹	X	X	X	X	X	X	X
Dyspepsia (indigestion)	X		X	X	X	X	X		
Emergency contraception	X	X ¹	X	X	X	X	X	X	
Erectile dysfunction	X							X	
Folliculitis	X							X	
Fungal infections of the skin ^f	X		X	X	X	X	X		
Gastroesophageal reflux disease (heartburn)	X	X ¹	X	X	X	X	X	X	X
Head lice	X						X		
Headache ^g	X		X	X	X	X		X	
Hemorrhoids ^h	X	X	X	X	X	X	X	X	X
Herpes labialis/simplex (cold sores)	X	X ¹	X	X	X	X	X	X	X
Herpes zoster (shingles) prevention	X	X ¹		X ²	X ⁴	X ⁵	X	X	
Impetigo	X	X ¹	X	X	X		X	X	X
Influenza treatment	X						X	X	
Insect bites ⁱ	X		X	X	X	X		X	X
Irritant contact dermatitis ^c	X	X							X
Joint pain (minor or mild) ^j	X		X	X	X	X			
Malaria prevention	X				X ³		X		
Mouth/oral/aphthous ulcers ^k	X	X	X	X	X	X	X	X	
Muscle pain (minor or mild) ^l	X		X	X	X	X	X	X	X
Nasal congestion ^p	X		X	X	X	X	X		
Nausea	X		X		X	X	X		

Table 1. Cont.

Conditions ☒	Alberta *	Manitoba	New Brunswick	Newfoundland and Labrador	Nova Scotia	Prince Edward Island	Quebec	Saskatchewan	Ontario **
Nausea and Vomiting	X			X			X		
Nausea/vomiting of pregnancy ¹	X	X					X		
Obesity	X							X	
Onychomycosis	X								
Pinworms/threadworms	X	X ¹	X	X	X	X	X		
Pregnancy (requiring prenatal vitamins)	X						X		
Seborrhoeic dermatitis ^m	X	X		X		X			
Sleep disorders (minor or mild) ⁿ	X		X	X	X	X			
Smoking cessation/nicotine dependence ^o	X	X	X	X	X	X	X	X	X
Sore throat ^p	X		X	X	X	X	X		
Tinea corporis infection (ringworm) ^f	X	X ¹	X	X	X	X	X	X	
Tinea cruris infection (jock itch) ^f	X	X ¹	X	X	X	X	X	X	
Tinea pedis infection (athlete's foot) ^f	X	X	X	X	X	X	X	X	
Upper respiratory tract conditions ^q	X		X	X					
Urinary tract infection (UTIs) ^r	X	X ¹	X	X	X ⁴	X	X	X	X
Urticaria ¹	X	X	X	X	X	X	X		X
Vaginal candidiasis (yeast infection)	X	X ¹	X	X	X	X	X		
Vasomotor rhinitis	X	X							
Viral conjunctivitis	X								
Warts ^s	X	X ¹	X	X	X	X			X
Xerophthalmia (dry eyes)	X		X	X	X	X			

* Pharmacists with their APA (additional prescribing authorization) in Alberta can prescribe for conditions beyond what is represented in this table. ** Ontario conditions pending regulatory approval by the government. ¹ Proposed prescriptive authority (not yet authorized); ² Prescribing allowed under Newfoundland and Labrador Regulations Appendix B—Prescribing for a Preventable Disease; ³ Prescribing allowed under Nova Scotia Regulations Appendix E—Prescribing Preventative Medicines; ⁴ Prescribing allowed under Nova Scotia Regulations Appendix G—Prescribing for a Diagnosis Supported by a Protocol; ⁵ Prescribing allowed under Prince Edward Island Regulations Schedule A—diseases for which a vaccine may be prescribed and administered with special authorization; ^a Defined as mild acne in New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, and Saskatchewan; ^b Defined as mild to moderate eczema in Quebec; ^c Defined as mild to moderate atopic dermatitis in Newfoundland and Labrador; ^d Defined as oral thrush in Saskatchewan and Ontario; thrush in New Brunswick; oral candidiasis in Newfoundland and Labrador; oral fungal infection (thrush) in Nova Scotia and Prince Edward Island; thrush consecutive to the use of corticosteroid inhaler in Quebec; ^e Defined as pre-menstrual and menstrual pain in New Brunswick; ^f Defined as skin fungal infections in New Brunswick; fungal infection of the skin in Nova Scotia, Prince Edward Island and Newfoundland and Labrador; defined as tinea infection (corporis, cruris, pedis) in Saskatchewan; ^g Defined as mild headache in New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador; ^h Defined as unspecified hemorrhoids without complication in Manitoba; ⁱ Defined as bites, bug bites and stings in New Brunswick; mild urticaria (including bites and stings) in Nova Scotia, Prince Edward Island and Newfoundland and Labrador. In Ontario, includes tick bites; ^j Defined as minor joint pain and minor muscle pain in New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador; defined as musculoskeletal strains and sprains in Saskatchewan and Ontario; ^k Defined as mouth ulcers in Quebec, oral ulcers in New Brunswick, Nova Scotia, and Prince Edward Island; recurrent oral aphthae in Manitoba; aphthous ulcers in Newfoundland and Labrador; oral aphthous ulcer in Saskatchewan; ^l Defined as vomiting of pregnancy (unspecified) in Manitoba and defined as nausea and vomiting of pregnancy in Quebec; ^m Defined as seborrhoeic dermatitis (excluding pediatric) in Manitoba and seborrhea in Newfoundland and Labrador; ⁿ Defined as mild insomnia in Newfoundland & Labrador; ^o Defined as tobacco cessation in Saskatchewan. In some provinces (e.g., Ontario), prescribing for smoking cessation and nicotine dependence is included under separate legislation from prescribing for ambulatory conditions; ^p Defined as sore throat (excluding strep throat) in nova scotia and upper respiratory conditions (mild—cough, nasal congestion, sore throat) in Newfoundland and

Ref: Nakhla N, Shiamptanis A. Pharmacist Prescribing for Minor Ailments Service Development: The Experience in Ontario. *Pharmacy*. 2021;9(2):96. doi:10.3390/pharmacy9020096

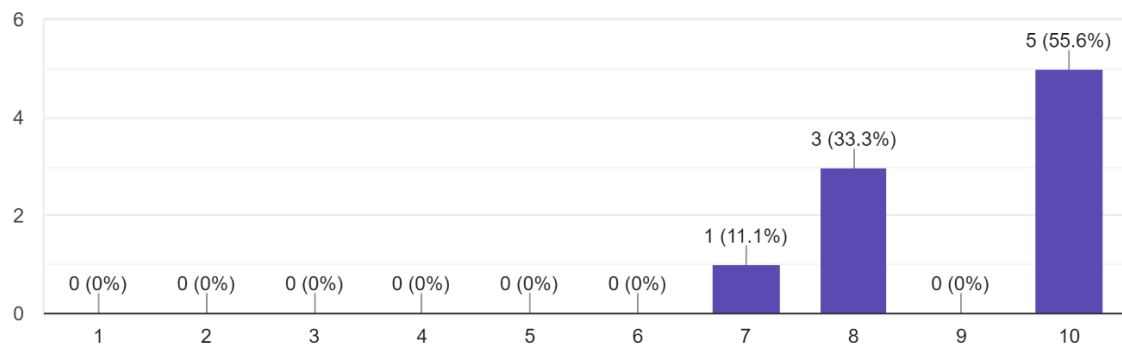
Appendix C

Preliminary survey results

Table 1: Results of the preliminary survey, wherein 10 Ontario pharmacists were provided an online electronic questionnaire post exposure to the Minor ailment tool.

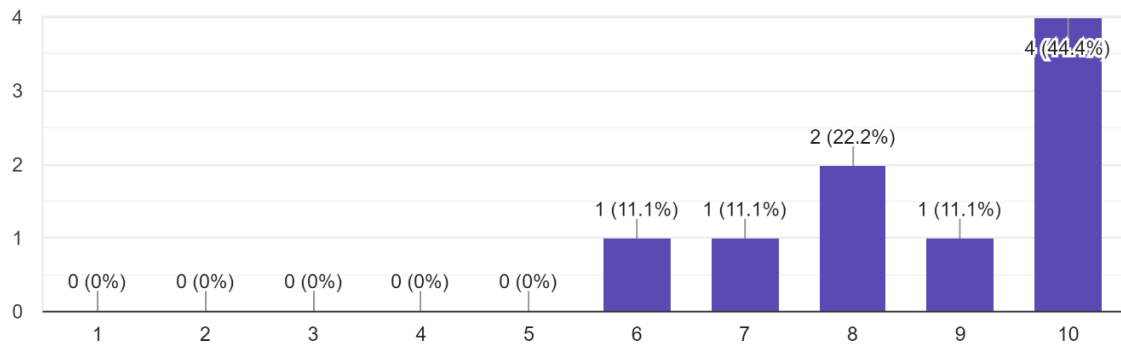
Do you think an app like this would be useful for minor ailment assessment/prescribing by pharmacists?

9 responses



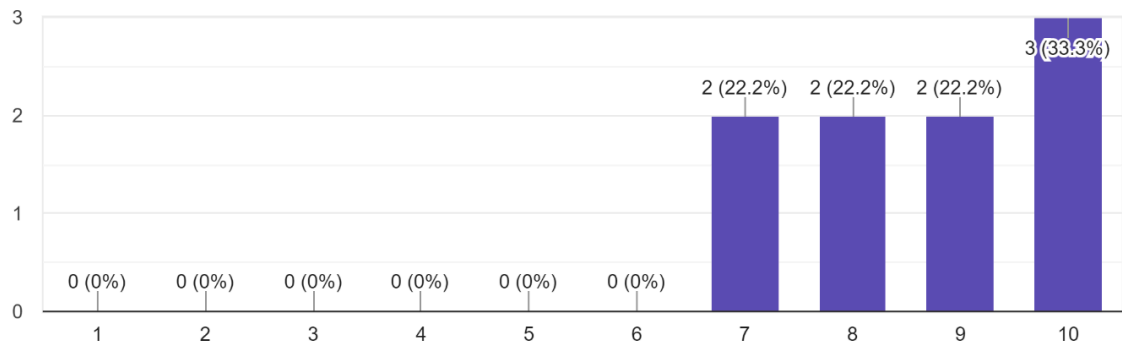
How likely would use an app like this in your pharmacy if/when regulations are approved?

9 responses



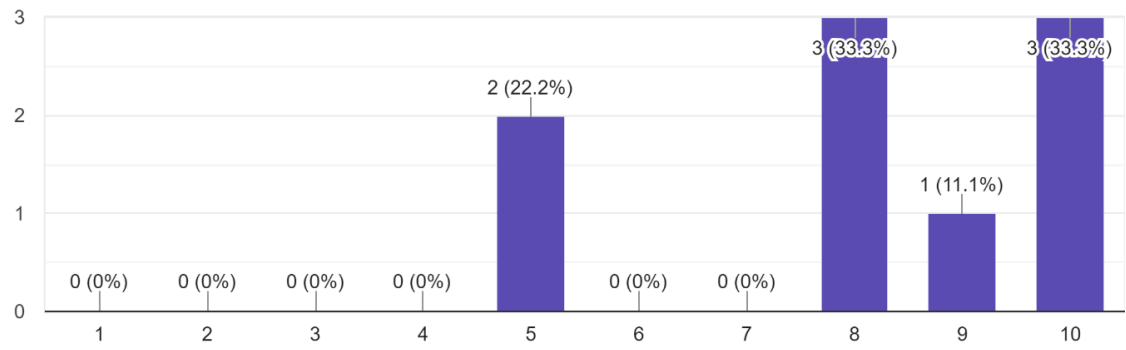
Would this tool give you more confidence in assessing/diagnosing/prescribing for minor ailments?

9 responses



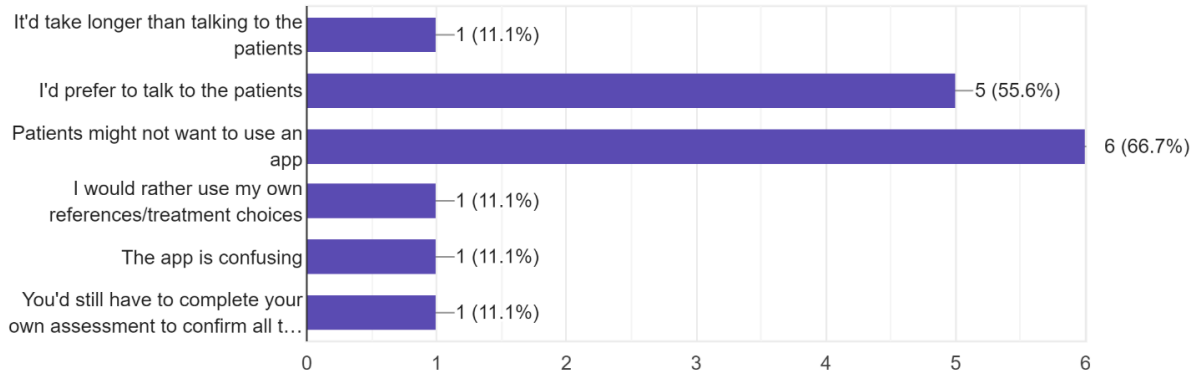
Would this tool lessen time needed for documentation of patient assessments?

9 responses



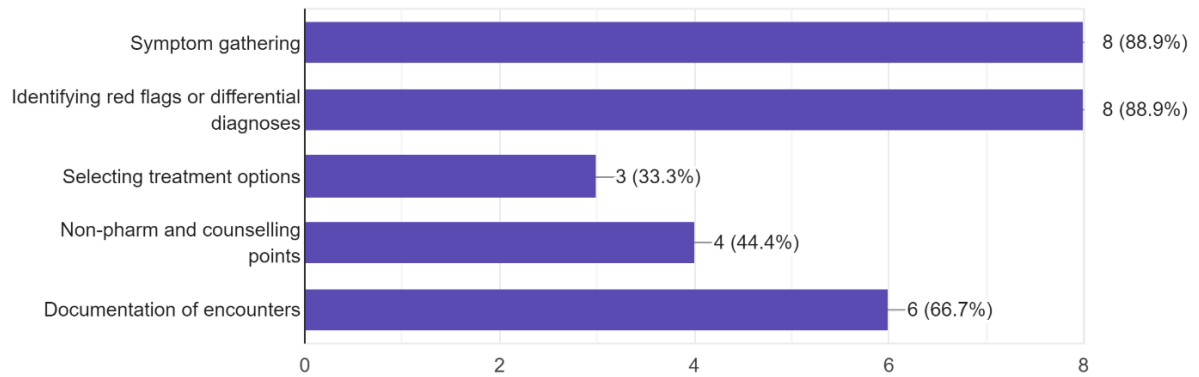
What barriers would stop you from using the app in your practice?

9 responses



Which of these is made easier by using the app?

9 responses



Appendix D

Survey material

PharmAssess software tool Usability Questionnaire

Help Box (to be available through the survey)

For any questions about the study itself, please contact the principal researcher:

Dr. Wasem Alsabbagh

Phone: +1 519 888 4567 ext. 21382

Email: wasem.alsabbagh@uwaterloo.ca

Members of the research team are:

Kelly Grindrod, School of pharmacy, University of Waterloo

Elena Neiterman, School of Pharmacy, University of Waterloo

Humayra Tasnim. School of Pharmacy, University of Waterloo

This study has been reviewed and received ethics clearance from the University of Waterloo Office of Research Ethics (REB 44005). If you have questions or concerns about research ethics related to this study, please contact the University of Waterloo Research Ethics Board at:

Phone: 1-519-888-4567 ext. 36005

Email: reb@uwaterloo.ca

If you are experiencing technical issues when completing the survey, please contact the Survey Research Centre at:

Email: srcccinb@uwaterloo.ca.

This research study is being conducted by Professor Wasem Alsabbagh and his research team at the University of Waterloo, School of Pharmacy. The survey is going to be administered by the Survey Research Centre (SRC). The purpose of this study is to learn about the feasibility and potential impact of a clinical innovative software tool to support pharmacists for minor ailment prescribing. The data collected will be used to refine the tool and enhance its acceptability and effectiveness, with the aim of improving prescribing for minor ailments and optimizing patient care. The survey will take about 15 minutes to complete, and you must be a practicing pharmacist, authorized to prescribe for minor ailment in the province of Saskatchewan, or interested to prescribe for minor ailment in Ontario and working regularly at a community (at least 8 hours per week). In appreciation of your time commitment, you will receive a free subscription of this software tool for 90 days at your pharmacy.

Participation in the survey is voluntary. You can withdraw your participation at any time by not submitting your responses or closing the survey window. You can decline to respond to any question by leaving it blank, unless it is needed to determine your eligibility for the survey. When information is transmitted over the internet, privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). The SRC will collect your contact information such as name, phone number, and email address. This information will be stored separately, which will not be linked to your survey responses. However, if you have consented to participate in one-to-one interview additional to this survey, then researchers may contact you via SRC. The SRC temporarily collects your computer IP address to avoid duplicate responses in the dataset. IP addresses will be stored until the window to complete the survey closes at which point, they will then be deleted. When provided to the researchers, all the data collected will be summarized and the data will be anonymized so that no individual or organization can be identified from these summarized results. Therefore, researchers will have no way of identifying you or contacting you about your responses. This also means that once you have submitted your responses, you will not be able to withdraw from the survey because researchers will have no way of identifying your responses. The survey responses will be stored on University of Waterloo research team's secured computers for a minimum of seven years. An anonymized version of the results will be published in academic thesis and scientific manuscript form. Making anonymous results publicly available allows researchers to verify results and avoid duplicating research.

CONSENT

By indicating your consent, you are not waiving your legal rights or releasing the investigators or involved institutions from their legal and professional responsibilities. By completing this survey, you consent to allow your data, including anonymous quotations from open-ended questions, to be used for research purposes.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (Committee REB # 44005). If you have any questions related to participation in this study, please click on the Help Box button.

I consent to participate in this survey.

1. Yes
2. No

Please answer a few classifying questions to ensure that questions later in the survey are relevant for you.

Q1. In what province do you practice pharmacy?

- 01 Saskatchewan
- 02 Ontario
- 03 Other
- 04 Northwest Territories

Q2a The software tool called PharmAssess has been developed to facilitate pharmacist prescribing for minor ailment (PPMA). Have you been using this software tool on at least 5 different patients within a period of 4 weeks or less?

1. Yes
2. No

Q2b The software tool called PharmAssess has been developed to facilitate pharmacist prescribing for minor ailment (PPMA). Have you been using this software tool and solved the case studies provided within a period of 4 weeks or less?

1. Yes
2. No

To start, we have a few questions that will allow us to better understand the participants in our survey.

Q3 What degrees/certificates have you completed? Check all that apply:

- BScPhm
- PharmD
- MScPhm
- PhD.
- Other, please specify _____

Q4. How many years of experience do you have in prescribing for minor ailments

- a. 0
- b. under 6 month
- c. 6 months to under 1 year
- d. 1 to under 3 years
- e. 3 to under 6 years
- f. 6 years or longer

Q5 In what type of community pharmacy do you practice in most of the time?

- Independent (one owner up to 6 stores)
- Chain (more than 6 stores with one owner, e.g., PharmaPlus, Medical Pharmacy)
- Banner (e.g., IDA, Guardian, Pharmasave)
- Franchise (e.g., Shoppers Drug Mart, Medicine Shoppe)
- Mass merchandiser/Food store (e.g., Loblaws, Walmart)
- Other, please specify _____

Q6 What is your current position at this community pharmacy? Select all that apply.

- Manager
- Owner
- Full-time staff
- Part-time staff
- Freelance/ Relief
- Other, please specify (14)

#	Statements	N/A	1	2	3	4	5	6	7
1.	The software tool was easy to use.	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
2.	It was easy for me to learn to use the software tool	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
3.	I like the interface of the software tool	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
4.	The information in the software tool was well organized, so I could easily find the information I needed.	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
5.	I feel comfortable using this software tool in community settings.	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
6.	The amount of time involved in using this software tool has been fitting for me.	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
7.	I would use this software tool again.	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE
8.	Whenever I made a mistake using the software tool, I could recover easily and quickly.	<input type="checkbox"/>	DISAGREE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AGREE

9.	This software tool provides an acceptable way to deliver PPMA services.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
10.	The software tool adequately acknowledged and provided information to let me know the progress of my action.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
11.	The navigation was consistent when moving between screens	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
12.	The interface of the software tool allowed me to use all the functions (such as entering information, responding to reminders, viewing information) offered by the software tool).	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
13.	This software tool has all the functions and capabilities I expected it to have.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
14.	The software tool would be useful for my PPMA practice.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
15.	The software improved my access to delivering PPMA services.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
16.	The software helped me manage my patients' health effectively.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
17.	The software tool made it convenient for me to communicate with my patients.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
18.	Using the software tool, I had many more opportunities to interact with my patients.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
19.	I felt confident that any information I sent to my patients using the software tool would be received.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
20.	I felt comfortable providing PPMA service to my patients using the software tool.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE
21.	Overall, I am satisfied with this software tool.	<input type="checkbox"/>	DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE

Q7. Since you have watched the PharmAssess tutorial video and used the software tool to prescribe for minor ailments. Please indicate how much you agree or disagree with the following statements with regards to using the software tool in your community pharmacy.

Color codes for each component of feasibility

Usability

Ease of use

Effectiveness

Efficiency

User satisfaction

Acceptability

Score calculation

In this questionnaire, 1 - strongly disagree, 2 – disagree, 3 – somewhat disagree, 4 – neither agree nor disagree, 5 – somewhat agree, 6 – agree, 7 – strongly agree

To determine the usability of an app, calculate the total and determine the average of the responses to all statements. The higher the overall average, the higher the usability of the app.

Source: Zhou L, Bao J, Setiawan A, Saptono A, Parmanto B, (2019), "The mHealth App Usability Questionnaire (MAUQ): Development and Validation Study", *JMIR mHealth and uHealth*, 7(4):e11500. DOI: 10.2196/11500. PMID: 30973342

WHERE IS QUESTION 8?

Q9. How much time did it take for you on average to complete each PPMA consultation/case study using the software tool?

- Under 5 minutes
- 5 to under 10minutes
- 10 to under15minutes
- 15 to under 20minutes
- 20 to under 25 minutes

25 to under 30 minutes

30 to under 40 minutes

over 40 minutes

Where is question 10?

Please comment below.

Q11. Did this software tool decrease your overall workloads?

1 2 3 4 5 6 7
DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE

Comments:

Q12. Did this software tool improve your existing workflow?

1 2 3 4 5 6 7
DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE

Comments:

Q13. Will you recommend this software tool to your colleagues?

1 2 3 4 5 6 7
DISAGREE <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> AGREE

Finally, we have some demographic questions that will help us understand the characteristics of the pharmacists in our survey.

Q14 Please select the **gender identity** option(s) with which you identify:

(Select all that apply)

- Woman (includes cis women, trans women, and everyone else who identifies as a woman)
- Man (includes cis men, trans men, and anyone else who identifies as a man)
- Gender non-conforming
- Agender
- Questioning
- Trans
- Two-spirit
- Non-binary
- Another gender identity (please specify): _____
- I prefer not to answer.

Q15 In which year were you born? _____

Q16. Do you want to participate in a semi-structured interview? We would like to learn in detail about your experience of using this software tool at your community pharmacy. This information will be stored separately from your responses to maintain the anonymity.

- Yes
- No

Appendix E

Survey material

1. Can you briefly tell me about yourself, how long have you been working in this organization and/or have been in this profession?
2. Can you describe your experience of using this software tool during PPMA service?
3. Can you tell me about the usability of this software tool? For e.g., how does this software tool enable better patient management and delivery of PPMA service? How does it impact the time needed to complete PPMA service? Were you comfortable using this software tool?
4. Can you tell me about the usefulness of this software tool? For e.g., how do you think this software tool may have helped to produce satisfactory result in terms of delivering PPMA service?
5. What do you like or dislike about this software tool?
6. How can this software tool be integrated into your existing workflow?
7. What are some any barriers/facilitators to the implementation of this software tool into the workflow?
8. What are your suggestions for improving this software tool?
9. Is there anything that you would like to add?

Appendix F

Case studies

Please use the software tool to solve all the following simulation case studies within a period of 4 weeks. Then participate in the online survey where we would like to get your perspective about using the tool in your community pharmacy.

Case #1 Gastroesophageal reflux disease (GERD)

T.D is a 50-year-old male with complaint of heart burn for about last four weeks. The patient feels nauseas after each big meal followed by chest pain that lasts between fifteen minutes to an hour. These symptoms are more severe at nighttime. Patient reports taking antacid tablets such as Tums up to four times daily, however this only provided short term relief. Patient does not have any other symptoms such as regurgitation, vomiting, blood in his stool, or unintentional weight loss.

Medical history

- Type 2 diabetes for ten years
- Obesity
- Hypertension for three years
- No known allergy to food, medication, or environment

Social history

- Patient drinks alcohol occasionally.
- Patient is a regular smoker and smokes up to ten cigarettes every day.
- Patient does not exercise

Current medication

- Metformin 500 mg by mouth twice daily
- Diltiazem 240 mg by mouth once daily

Physical examination

- Blood pressure = 130/80
- Weight 95 kg
- Height 5 feet 8 inches

Case #2 Uncomplicated Urinary Tract Infection (UTI)

C.S is a 25-year-old female who came to the pharmacy with a report of feeling pain and burning sensation during urination. She also mentioned that there is a constant urgency to pass urine hence she is urinating more frequently. Patients wake up during the nighttime to urinate. Patient feels discomfort in her suprapubic region. Patient has no signs of fever or chills. She denied any vaginal discharge or blood in her urine.

Medical history

- Patient has no other medical problems
- Patient had similar symptoms two years ago which resolved after taking antibiotics
- No past pregnancies
- No sexually transmitted disease
- No known allergies

Social history

- Patient is sexually active (monogamic)
- Patients use condoms for protection and 2nd method of contraception

Current medication

- Patient is on birth control pills (Alesse 21) for contraception

Physical examination

- Blood pressure 120/80
- Body temperature 97 Fahrenheit
- Pulse 80

Case # 3 Atopic Dermatitis

T.S is a 4-year-old boy with dryness, red patches with small, raised bumps and scaling on his hands, feet and inside the bend of his elbows and knees. His mother brought him to the pharmacy to seek remedy. T. S's mother mentioned that patients itching gets more severe during nighttime. The patient's skin has become very sensitive to scratching. T. S's mother tried home remedies such as bathing patient with lukewarm water and using mild, hypoallergenic cleanser. She uses unscented lotion to moisturize the patient's skin, yet the symptoms did not resolve.

Medical history

- Patient has asthma

Social history

- Patient has another infant sibling with similar symptoms

Current medication

- Fluticasone, 1 spray in each nostril once daily

Physical examination

- Red, scaly patches on skin
- Small, raised bumps on hands, feet and inside the bend of his elbows and knees

Case # 4 Musculoskeletal pain – Low back pain

J.M is a 50-year-old male. He works as a manager at an insurance company. A few days ago, he bent down to check the tires of his car and felt an ache in his lower back while standing up. He didn't consider this to be serious and went to play soccer with his 8-year-old son the next day. After the game, he could feel the pain, but this time more severe and radiating from lower back down both of his legs. Patient denies any swelling on his lower back or pins and needles in his legs. J.M complained that the pain would aggravate if he were in a seated position for more than 20 minutes at a stretch. He finds comfort in standing and walking around for a bit. He thinks that the back pain gets worse by the end of the day. He came to the pharmacy to seek remedy.

Medical history

- Patient had previous episodes of back pain which resolved after taking NSAIDs
- Patient has mild hypertension
- No known allergies

Social history

- Patient is a smoker
- Patient's work requires him to sit for long hours
- Patient is active and likes to play sports

Current medication

- Ramipril 2.5 mg by mouth once daily

Physical examination

- Blood pressure 139/89
- No swelling on lower back

Case # 5 Musculoskeletal pain – Low back pain

B.S is a 30-year-old male. He works at a bank. He came to the pharmacy with a complaint of headache with slow onset often lasting between 1 to 3 hours. He describes the pain as non-throbbing that radiates from the back of his head down towards the neck. The headaches are becoming more frequent these days and he feels stiffness in his cervical region. B.S mentioned that headache is aggravated when using the computer for a long period of time. The patient is otherwise healthy and denies any symptoms of dizziness, nausea, or vomiting.

Medical history

- Patient has been clinically diagnosed with depression

Social history

- Patient drinks a glass of wine everyday
- Patient works long hours in front of computer

Current medication

- Celexa 20 mg by mouth once daily

Physical examination

- Blood pressure 120/80