CLINICAL EVALUATION OF ARTIFICIAL INTELLIGENCE AND AUTOMATION TECHNOLOGY TO REDUCE ADMINISTRATIVE BURDEN IN PRIMARY CARE

Centre for Digital Health Evaluation, Women's College Hospital Institute for Health System Solutions and Virtual Care

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Acronyms

AI   Artificial intelligence

CDHE Centre for Digital Health Evaluation

CHC   Community health centre

eCE   eHealth Centre of Excellence

EMR   Electronic medical record

HPI   History of presenting illness

NPLC Nurse practitioner-led clinic

OH   Ontario Health

PAN   Patient Advisors Network

PCP   Primary care provider

PPE   Patient Partner Evaluator

RPA   Robotic process automation

SME   Subject matter expert

VCL   Virtual Care Laboratory

WIHV Women's College Hospital Institute for Health System Solutions and Virtual Care

Operational Definitions

Administrative task(s): Documentation and non-clinical activities required to coordinate care within and across organizations, including tasks such as scheduling appointments, writing medical notes and referral letters, filling and renewing prescriptions, managing medication orders, resolving billing issues, etc.[1]

Artificial intelligence (AI) scribe: AI technology that uses machine learning models, such as automatic speech recognition and natural language processing systems, to summarize conversations between patients and healthcare providers into written text. AI scribes can produce a transcript of the conversation, a medical note, referral letters, and patient-facing documents.[2–4] In this report, AI scribes may be referred to as a product if referencing a specific AI scribe.

Artificial intelligence (AI) scribe vendor: A company that developed an AI scribe (i.e., the product).

Bot: For the purposes of this report, a bot refers to the robotic process automation (RPA) solution developed to automate the sending of reminders to patients to book follow-up appointments based on the information documented in the most recent medical note. Refer to the definition of RPA below for more details.

Clinical encounter: An interaction between a patient and healthcare provider(s) for the purpose of providing healthcare service(s) or assessing the health status of a patient.[5]

Electronic medical record (EMR): A digital collection of medical information about an individual, including information about a patient's medical history, such as diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory test results.[6,7]

Medical note: A summary of essential information about a patient that is unique to each clinical encounter. A medical note typically includes critical elements about a patient's health status and concerns, information that supports the treatment or procedure provided, and any other details that may be useful for the healthcare provider and other healthcare professionals using the medical note to get a synopsis of the patient's health.[5]

Primary care provider: Healthcare provider (i.e., family physician, nurse practitioner) that provides primary care services.[8,9]

Robotic process automation: Software technology that can emulate repetitive human actions that interact with digital systems and software, such as EMRs.[10,11]

Executive Summary

Background and Objective

In Ontario, more than 70% of primary care providers (PCPs) report feelings of burnout due to an increase in administrative work and the chronic shortage of healthcare professionals. Artificial intelligence (AI) scribes and robotic process automation (RPA) have emerged as potential solutions to address these challenges, and this project aimed to evaluate their impact on primary care and potential benefits for the Ontario healthcare system.

Methods

Over 150 PCPs across Ontario were provided licenses to an AI scribe for a period of three months, with a subset of PCPs also trialing an RPA solution. The Women's College Hospital Institute for Health System Solutions and Virtual Care (WIHV) led a clinical evaluation of AI scribes and RPA technology, leveraging methods in both laboratory and real-world settings.

Key Findings

- In the lab setting, using an AI scribe was associated with a 69.5% reduction in time spent documenting during clinical encounters ($p<0.001$).
- In routine practices, PCPs using AI scribes reported a three-hour reduction, per week, in time spent on administrative tasks afterhours ($p<0.05$).
- PCPs using AI scribes also reported reductions in administrative burden, cognitive load, and afterhours work; improved efficiency and documentation practices; increased job satisfaction, professional fulfillment, and work-life balance; and perceived improvements in quality of care.
- Most PCPs saw value in AI scribes, and many were willing to pay for them, but very few were willing to pay the current market price.
- PCPs were also receptive to automating other administrative tasks that contribute to their workload, especially for time-consuming repetitive tasks driven by mouse-clicks and keystrokes.

Overall, although AI scribes and other automation processes can help reduce the administrative burden for PCPs, ongoing evaluation is necessary to ensure that these technologies continue to support PCPs while also optimizing accuracy, effectiveness, and safety for both patients and providers as performance may vary overtime.

1.0   Introduction

Context

In Ontario, more than 70% of primary care providers (PCPs), including family physicians and nurse practitioners (NPs), report feelings of burnout due to an increase in administrative work and the chronic shortage of healthcare professionals.[12,13] In fact, PCPs spend over 40% of their time on administrative tasks (19 hours per week),[14,15] which includes but is not limited to writing medical notes and referral letters, filling and renewing prescriptions, managing medication orders, ordering and reviewing lab results, completing third-party forms and sick notes, and following-up on patient appointments. In many cases, this work usually takes place afterhours, extending their workday and negatively impacting their work-life balance. Some PCPs have also reduced their clinical hours to manage this administrative workload, thus impacting quality of and access to care.[16,17]

Artificial intelligence (AI) scribes and robotic process automation (RPA) have emerged as potential solutions to address these challenges and improve the patient and provider experience.[2,3,11] AI scribes are software applications that use a microphone to listen to spoken conversations between a patient and provider and AI technologies to understand and summarize clinically relevant information into structured electronic medical notes.[3] RPA is software technology that can perform repetitive rule-based tasks in place of human action.[11] Both AI scribes and RPA technologies have the potential to reduce a substantial portion of provider-driven documentation, which may alleviate administrative burden and burnout.[2] In addition, these solutions are quickly gaining popularity and many healthcare organizations have adopted these tools in small pilot trials.[16,17] However, the impact and effectiveness of AI scribes and RPA solutions have not been formally assessed among PCPs representative of Ontario's primary care landscape.

Purpose and Objectives

The aim of this project was to evaluate the impact of AI scribes and an RPA solution on the administrative burden experienced by PCPs across Ontario. The specific objectives were to:

1) Evaluate the functionality, performance, and compatibility of AI scribes in primary care clinical workflows, and

2) Determine the impact of AI scribes and an RPA solution on PCP and patient experiences.

2.0   Methodology

Study Setting and Timeline

In February 2024, an expression of interest was sent to all PCPs in Ontario, inviting them to participate in an evaluation of AI scribes and an RPA solution. Nearly 1,000 PCPs expressed interest in participating in the evaluation. To ensure representation of Ontario's primary care landscape, OntarioMD and the eHealth Centre of Excellence (eCE) led the selection of over 150 PCPs to match the provincial profile based on criteria such as provider type, gender, practice type, years in practice, patient population, catchment area, and electronic medical record (EMR) competency. Once selected, PCPs were randomly assigned to one of three AI scribe products. A subset of PCPs were also offered access to an RPA solution (i.e., a bot) developed by eCE that automated the sending of reminders to patients to book follow-up appointments.

Upon implementation of the AI scribe and bot (where applicable), Women's College Hospital Institute for Health System Solutions and Virtual Care (WIHV) led the clinical evaluation of AI scribes and the bot. A total of 162 PCPs were enrolled into the AI scribe evaluation study, 30 of which also participated in the RPA component. The study spanned from March 18 to July 5, 2024.

Overview of Data Collection Activities

To address the objectives described above, the following research activities were conducted in both a lab environment and real-world primary care settings:

- An **environmental scan** of academic and grey literature to identify current applications of and implementation considerations for AI scribes and RPA in primary care.

VIRTUAL CARE LAB

- **Simulated clinical encounters** between standardized patients and PCPs (n=9) to measure the amount of time spent documenting with and without the use of an AI scribe.
- **Administrative workflow simulations** with PCPs (n=3) and an administrative staff member (n=1) to measure the amount of time spent sending follow-up appointment reminders to patients without the use of the bot.
- A **competitive analysis** of six AI scribes to evaluate accuracy and quality in medical documentation and other technical features.

- **Pre-** (n=162) **and post-implementation surveys** (n=155) with PCPs to understand implementation and change management considerations; the impact of using an AI scribe on administrative burden, care delivery, and satisfaction; and perceptions of RPA (response rate for pre-implementation survey: 98.8%; response rate for post-implementation survey: 98.1%).

- **Semi-structured interviews with PCPs** (n=11) to understand their overall experiences using an AI scribe, including implementation and change management processes, impact on their administrative burden, and facilitators and barriers to sustained use.

- **Semi-structured interviews with patients** (n=6) who had at least one appointment with their PCP using an AI scribe to capture their overall attitudes towards AI scribes and automation processes, and to understand the impact that AI scribes have on quality of care and patient-provider relationships.

- **Quantitative data analysis of AI scribe utilization data**, from March 18 to July 5, 2024, to understand patterns of engagement, use, and change management supports.

- **Focus groups** with practice advisors from OntarioMD (n=6), change management specialists from eCE (n=3), and AI scribe vendor executives and staff (n=6) to understand change management and implementation considerations needed to support PCPs in the adoption of AI scribes and RPA.

- **Consultations** with subject matter experts (SMEs) and patient partner evaluators (PPEs).
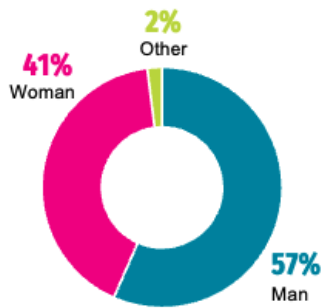
3.0 Results: AI Scribes

Characteristics of Primary Care Providers

Figure 1 displays the demographics and practice characteristics of 152 PCPs that responded to both the pre- and post-implementation survey, had reported AI scribe usage data, and participated in the evaluation from March 18 to July 5, 2024. The majority of PCPs were family physicians (n=128, 84.2%) with over 10 years in practice (n=86, 56.6%) in a group or team-based setting (n=82, 53.9%). Over half of the PCPs provide care to historically underserved or equity-deserving communities and 15.8% of PCPs provide care to Indigenous communities. While PCPs from all Ontario Health (OH) regions were represented, one-third were from the West region (n=52, 34.2%) and the majority mainly served urban/suburban patient catchments (n=101, 66.4%).
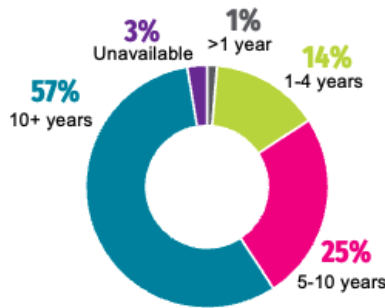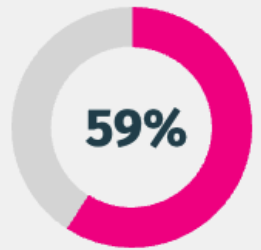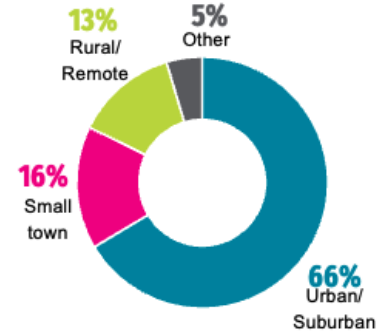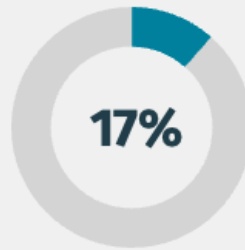
84% Family Physician | 16% Nurse Practitioner

Gender

- 41% Woman
- 2% Other
- 57% Man

Years in Practice

- 3% Unavailable
- 1% >1 year
- 14% 1-4 years
- 57% 10+ years
- 25% 5-10 years

Patient Catchment

- 13% Rural/Remote
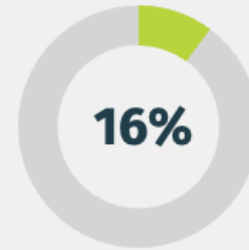- 5% Other
- 16% Small town
- 66% Urban/Suburban

59% serve a significant proportion of historically **underserved populations†**
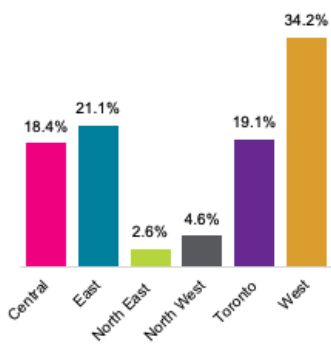
17% serve a significant proportion of **Indigenous communities‡**

16% have **prior use and/or experience** with AI scribes

† Underserved refers to an increased likelihood that individuals who belong to a certain population (and people can belong to more than one) may experience difficulties in obtaining needed care, receive less care or a lower standard of care, experience different treatment by healthcare providers, receive treatment that does not adequately meet their needs, or that they will be less satisfied with healthcare services than the general population.[18]
‡ Indigenous peoples is a collective term for the original peoples of North America and their descendants and includes First Nations peoples registered under the *Indian Act*, North American Indians not registered under the *Indian Act*, Inuit, and Métis.[19]

OH Region

- Central: 18.4%
- East: 21.1%
- North East: 2.6%
- North West: 4.6%
- Toronto: 19.1%
- West: 34.2%

EMR Competency

- Novice: 2.6%
- Intermediate: 45.4%
- Expert: 49.3%
- Unavailable: 2.6%

Practice Type

- Unavailable: 2.6%
- Other: 3.9%
- Sole Practitioner: 15.8%
- Nurse Practitioner Led Clinic: 3.9%
- Aboriginal Health Access Centres: 3.3%
- Community Health Centre: 10.5%
- Hospital or Academic-based: 5.9%
- Group or Team-based: 53.9%
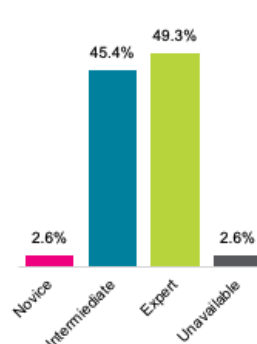
Figure 1. Demographic and practice characteristics of participating PCPs (n=152).

Current Literature on AI Scribes
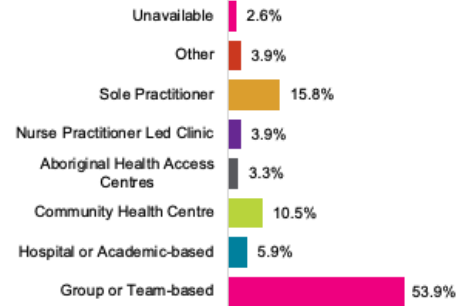
The environmental scan identified 51 resources on the current applications of AI scribes and RPA in primary care, with most studies originating from the United States (n=43), followed by Australia (n=3), Canada (n=3), and the Netherlands (n=1). Studies showed that using an AI scribe in primary care was associated with increased patient and provider satisfaction and productivity as a result of less time spent documenting per patient.[20,21] However, there remains uncertainty about their effectiveness in reducing administrative burden for providers, with some studies citing no change in the amount of time providers spent on afterhours charting[22] whereas others noted significant time saved.[4] Some studies also reported high error rates in AI-generated medical notes; thus, increasing documentation time in order to edit and revise the notes.[4,23]

While the environmental scan offered a preliminary understanding of the impacts of AI scribes in primary care, existing literature lacks specific data on time savings and a comprehensive comparison of the performance of different AI scribes. In addition, there is a lack of clarity on how AI scribes and RPA may complement each other to alleviate administrative burden, especially in a primary healthcare system like Ontario. As such, the implementation of AI scribes and RPA across a range of primary care practices in Ontario may offer additional insights.

Use and Engagement

From March 18 to July 5, 2024, 152 PCPs used an AI scribe in their practice, for a total of 17,415 encounters. Though the number of PCPs assigned to each AI scribe was similar, use varied by product: AI scribe #1 was used in 4,847 encounters; AI scribe #2 in 5,876 encounters; and AI scribe #3 in 6,692 encounters. Differences in usage may be attributed to some AI scribe products having a more user-friendly interface and an easy sign-in and launch process, but findings were not statistically significant. Most PCPs (85.5%) used their AI scribe daily or several times a week, with the majority using it on their desktop computer or laptop (96.2%), and some also using it on a mobile device (23.0%) or tablet (3.9%). Almost all PCPs (93.4%) used the medical note templates provided by the AI scribe, with 29.6% also using the dictation feature, and 14.5% using features for patient facing documents (i.e., patient handouts, summaries, visit notes).

Value and Impact

REDUCED ADMINISTRATIVE BURDEN AND BURNOUT

As observed in the Virtual Care Lab (VCL) during simulated clinical encounters, on average, PCPs spent less time on documentation when using an AI scribe (mean=100.3s, SD=62.7s) compared to encounters without an AI scribe (mean=328.6s, SD=90.5s). The use of an AI scribe was associated with a 69.5% reduction in total documentation time ($p < 0.001$) (Table 1). Notably, these measures likely underestimate the benefits of using AI scribes as most PCPs were new users still getting familiar with the technology.

Table 1. The amount of time, in seconds, spent by PCPs, per encounter, on various documentation behaviours with and without use of an AI scribe (n=9).

Effectiveness Measures	Scenario				% Difference
	Without AI Scribe		With AI Scribe		
	Mean[†]	SD	Mean[†]	SD	
Total typing *(seconds)*	328.6	90.5	98.6	65.1	−70.0%
Typing during visit	194.0	105.5	0.0	0.0	−100.0%
Typing after visit	134.6	106.5	98.6	65.1	−26.7%
Copy and pasting the AI scribe-generated medical note *(seconds)*	—	—	0.0	0.0	—
Total documentation time *(seconds)*[§]	328.6	90.5	100.3	62.7	−69.5%

[†]Amount of time spent on identified behaviour averaged across all encounters and PCPs.
[§]Documenting = Sum of total time spent typing, writing, and copying and pasting AI scribe medical note.

Based on the survey of 152 providers who participated in the implementation, prior to AI scribe use, on average, PCPs reported spending over 14 hours per week on administrative tasks. Upon implementation of an AI scribe in routine practice, on average, time spent on administrative tasks decreased by over three hours per week ($p < 0.05$), with a significant reduction in time spent on documentation afterhours (Figure 2).
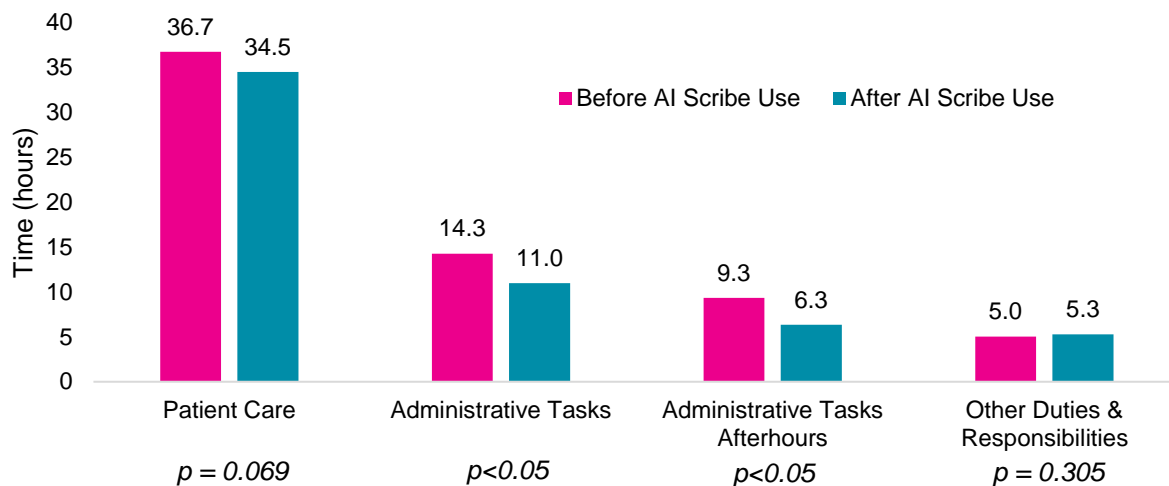
Figure 2. Average time, in hours per week, spent on various tasks before and after implementation of an AI scribe (n=152).

PCPs mentioned that one of the greatest benefits of using an AI scribe was the completion of their medical notes by the end of the day, reducing or entirely eliminating the need for afterhours documentation. Nearly half of PCPs reported minimal to no time spent on afterhours documentation when using an AI scribe in their practice. Most PCPs also reported reduced administrative burden (68.4%) and experienced less stress and/or burnout (55.3%). This likely contributed to improved work-life balance (55.3%), more time for personal/family life (49.3%), and improved job satisfaction and professional fulfillment (58.6%) for many PCPs. The benefits of AI scribes on administrative burden were more apparent in women compared to men, with a higher proportion of women agreeing or strongly agreeing that AI scribes significantly reduced the administrative burden they experienced (67.1% of women vs. 53.2% of men).

> *"This is the first Christmas in [20+ years] that I haven't had to spend time catching up on my notes… I have decided, I'm a later physician in terms of my career, that I'm gonna practice for another 10 years at least and that will bring me well past 65. So [AI scribes have] been a game changer for me personally."*
> – Family Physician

Notably, although both NPs and family physicians reported reduced time spent on administrative tasks, using an AI scribe was associated with a greater reduction in afterhours and/or at home documentation for NPs compared to family physicians (56.7% of family physicians vs. 84.2% of NPs, p-value = 0.028).

> *"My friends and family were surprised at me coming home at a reasonable time and having the energy to participate in activities, community volunteering events, and other functions. I felt much better about being a comprehensive long term family doctor. I never thought I'd say this, but I'm beginning to experience the magic of grass roots primary care again!"*
> – Family Physician

QUALITY AND COMPLETION OF NOTES

For PCPs who previously took days, weeks, or sometimes months to complete their clinical notes, using an AI scribe was particularly beneficial for timely completion of their notes and improved note quality. PCPs reported that the AI scribes generally produced better quality notes that were more detailed than if they had manually created notes from memory alone. PCPs also mentioned that using an AI scribe reduced stress associated with incomplete documentation.

> *"The miserable reality is that not only do I put in hours afterwards [to complete documentation], it is sometimes weeks or months later that I finish it and do the billing, and so it's really haphazard and horrendous and unacceptable and everything else. So, it's really been bad…*
>
> *With the [AI scribe], typically the visit is done and then I [can complete documentation] and do the billing right away and I never have to think about that visit again until it comes up for some other reasons. So, I truly love this. I wish I had it working all the time."*
> – Family Physician

REDUCED COGNITIVE LOAD

Three-quarters (75.7%) of PCPs reported reduced cognitive load during patient encounters when using an AI scribe. Almost half of all PCPs (48.0%) perceived that the quality of care they delivered improved as a result of reduced cognitive fatigue. PCPs felt that having an AI scribe enabled them to be more engaged with their patients (i.e., maintain eye contact, face the patient), focus on the conversation, and not have to worry about documenting the encounter. This focus also made it easier to gather comprehensive patient histories, formulate diagnoses/differentials, and develop plans for further testing and treatment; thus, increasing diagnostic accuracy.

> *"Documenting visits in the EMR is a significant admin burden that is relieved by the AI scribes. It's not just the time saving, it's feeling better being able to engage more with patients and not suffering the frustration of having to manually enter chart notes."*
> – Family Physician

Perceptions and Acceptability

PCP PERCEPTIONS AND ACCEPTABILITY

In general, PCPs found AI scribe-generated medical notes to be timely (73.0%) and accurate (65.8%). Nearly half (49.3%) of PCPs agreed that any errors made by the AI scribe were minor. These PCP experiences were also observed in the VCL, where the accuracy and quality of the AI scribe-generated transcripts and medical notes varied across AI scribe products, but in general, critical errors were seldom. All AI scribes typically had a deleted word or omission error where relevant components of the patient interaction were not included in the medical note (Table 2).

Table 2. Evaluation of the accuracy and quality of the transcript and medical note generated by the AI scribe.

Accuracy and Quality[†]	AI Scribe					
	AI Scribe #1	AI Scribe #2	AI Scribe #3	AI Scribe #4	AI Scribe #5	AI Scribe #6
Transcript						
Accuracy and Quality	Good	Excellent	Good	Good	Good	Excellent
Usefulness	Good	Excellent	Poor	Poor	Good	Excellent
Medical Note						
Accuracy and Quality	Excellent	Excellent	Excellent	Good	Good	Good
Usefulness	Excellent	Excellent	Good	Excellent	Good	Poor
Error Analysis						
Errors	Good	Good	Good	Good	Good	Poor
Error Types	Omission of some HPI and lifestyle factors	Omission of some HPI and lifestyle factors	Omission of some HPI, lifestyle factors, and social history	Omission of some HPI, lifestyle factors, and social history	Omission of some HPI	Omission of some HPI, lifestyle factors, and social history

HPI = History of presenting illness
[†]Composite measure based on assessment of individual elements informed by the evaluation framework and relative performance of all AI scribes.

PCPs described some limitations in the performance of AI scribes, including:

- Creating concise medical notes during complex, multi-issue appointments due to the non-linear nature of conversations between the patient and PCP.
- Distinguishing between multiple speakers (e.g., patient with caregiver, translator, etc.).
- Interpreting multilingual conversations and/or conversations where a speaker has limited English proficiency or enunciation difficulties.
- Capturing physical examinations (unless verbalized); nuances in a patient's speech, tone, and body language; and pertinent negatives.

As a result, when an AI scribe was used, PCPs reported that they always reviewed, proof-read, and edited the AI-generated note before saving it in their EMR. Nonetheless, almost half of all PCPs reported improved accuracy and quality in their clinical documentation since using an AI scribe and 73.0% of PCPs agreed that the benefits of using an AI scribe outweighed any inconveniences. Most PCPs (82.3%) want to continue using AI scribes in their practice long-term.

PATIENT PERCEPTIONS AND ACCEPTABILITY

In general, most patients positively viewed AI scribes and appreciated that there was an objective, word-for-word transcription of their encounter that providers could reference when finalizing medical notes. Many patients reported that when an AI scribe was used during their encounter, their PCP spent less time typing and more time directly facing them. This made interactions with their PCP feel more personal due to increased face-to-face time. Patients also noticed a change in their provider's body language and behaviour, describing their PCP as being both "mentally and physically present" when an AI scribe was used compared to feeling only "physically present" without the AI scribe. In addition, patients noticed that their PCP asked more questions about their well-being and explained findings and observations in greater detail when an AI scribe was used. However, some patients observed no change in their patient-provider relationship and a few patients expressed that they felt uncomfortable being recorded when discussing sensitive topics, such as financial well-being. When asked about data privacy and security concerns, patients expressed minimal hesitations, which was largely attributed to the long-standing relationships patients had with their PCPs with whom they trusted.

INFORMED CONSENT PROCESS

The consent process varied by AI scribe vendor, with most PCPs obtaining either verbal or written consent from their patients prior to using the AI scribe. Most PCPs (81.3%) felt confident explaining the informed consent process to their patients, although there was an initial learning curve on how to properly obtain informed consent. Some PCPs perceived the informed consent process as unnecessary, and others expressed the need for clinic- or institutional-wide consent for larger scale implementation. In some cases, administrative staff members were the ones who collected patient consent prior to the patient seeing their PCP.

When asked about the consent process, patients expressed being more focused on their health concerns than on the specific details of what they were consenting to. However, some patients expressed that they would like to consent to AI scribe use for every encounter with their PCP.

Implementation and Change Management

The majority of PCPs (95.4%) found learning to use an AI scribe easy. However, one-third of PCPs (32.2%) felt they could have benefited from additional supports, such as live information sessions or a video library, to become more familiar with the various features and customizable elements of the AI scribe (e.g., creating customized templates, patient-facing materials).

The main barriers to implementing and using an AI scribe in their practice included: 1) lack of appropriate hardware (i.e., microphones in each clinic room), and 2) lack of institutional standards or guidelines for use of AI products in healthcare settings; thus, delaying or prohibiting the use of AI scribes altogether. In addition, to improve usability and seamless integration of AI scribes with primary care workflows, PCPs reported that EMR integration would be beneficial.

As part of their participation in the evaluation, AI scribe licenses were provided to PCPs at no cost. The usual cost of an AI scribe license varies based on vendor, volume of use, and included features (e.g., AI note generation, dictation, multilingual availability, etc.), and typically ranges from $135 to $400 per month for unlimited use. Although the majority of PCPs were willing to pay to continue to use an AI scribe, the amount they were willing to pay was less than the market price (37.5% of PCPs were willing to pay up to $50 per month, 32.2% were willing to pay up to $100 per month, and 6.6% were willing to pay more than $100 per month). Many PCPs perceived the cost of an AI scribe license to be a barrier to long-term and sustained use, with nearly one-quarter (22.4%) reporting that they would only use an AI scribe if it was free. Many PCPs, particularly those working in community health centres (CHCs) or nurse practitioner-led clinics (NPLCs), indicated that they could not afford an AI scribe license without additional subsidies due to the business model of their practice, although they wanted continued access to the AI scribe long-term.

> *"Every family doctor should have access to fully funded AI scribes. It would greatly reduce burnout, improve family doctor retention, improve active listening with patients (and hence better care and a better patient experience), and most of all bring back the joy of family med!"*
> – Family Physician

4.0 Results: RPA

Automating Administrative Tasks

eCE led the development of a bot that automated the sending of reminders to patients to book follow-up appointments with their PCP based on information documented in the most recent medical notes in their patient chart. To achieve this task, the bot performed two sub-processes: patient identification and sending appointment reminders (Figure 3).
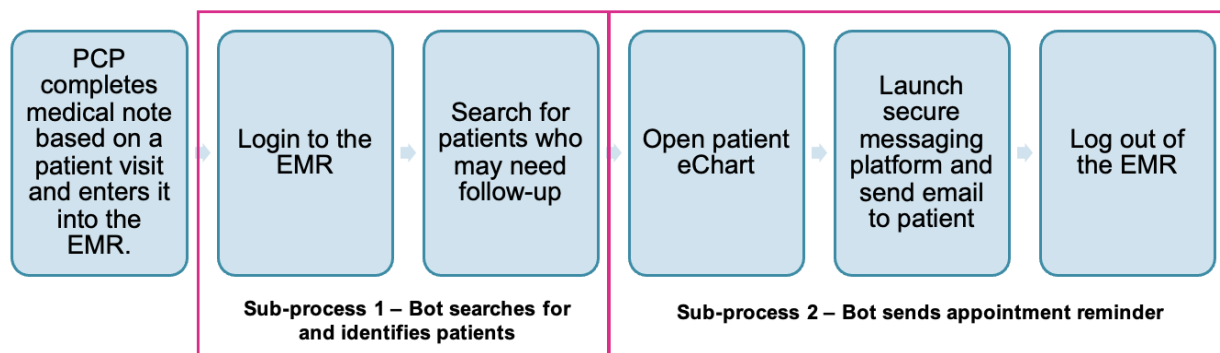

Figure 3. Process for the bot to assist PCPs and administrative staff in the automated sending of appointment reminders.

Use and Engagement

In total, 30 PCPs confirmed interest in trialing the bot in their practice, with 19 PCPs having signed and completed agreements with eCE and seven PCPs actively engaged in change management, onboarding, and/or deployment related activities with eCE. Due to the compressed timeline, four out of 30 PCPs had the bot fully implemented in their practice, resulting in nine messages sent to patients to book a follow-up appointment. Importantly, the bot only supported workflows that used TELUS PS Suite or OSCAR EMRs with Ocean patient messaging features. However, future enhancements may explore compatibility with other EMRs (e.g., Accuro EMR) or secure messaging platforms (e.g., Pomelo).

Perceived Value and Impact

IMPACT OF THE BOT ON ADMINISTRATIVE BURDEN

As observed in the VCL, on average, PCPs and administrative staff spend over one minute per patient sending follow-up appointment reminders (Table 3). Automating this repetitive task with a bot could create capacity for PCPs and staff to focus on more pressing tasks.[24] For example, assuming a practice sends reminders to patients to book follow-up appointments, if a PCP sees

an average of 25 patients per day and half require follow-up, using a bot could recover one hour per five-day work week for other tasks.

Table 3. Time spent sending appointment reminders.

Measure	Nurse Practitioner	Family Physician #1	Family Physician #2	Administrative Staff
Time spent sending follow-up appointment reminders per patient	77.0 seconds	50.8 seconds	86.9 seconds	84.9 seconds

Since most PCPs were still involved in change management activities at the conclusion of the evaluation period, they could only provide feedback on perceived effectiveness. Nonetheless, majority of PCPs agreed or strongly agreed (66.7%) that the bot had the potential to:

- Decrease administrative burden associated with managing follow-up appointments
- Streamline administrative workflows for sending follow-up appointment reminders
- Reduce the need for extensive follow-up communications with patients

IMPACT OF RPA ON ADMINISTRATIVE BURDEN

More broadly, PCPs recognized that while AI scribes were valuable, they are a partial solution to administrative burden. PCPs mentioned that there are several other tasks that contribute to administrative burden, such as completing forms, writing referral letters, and responding to queries. Overall, most PCPs viewed RPA positively and reported that it felt like the "natural next step" to reduce administrative burden, followed by task delegation to other team members.

> *"The hours I spend every day doing paperwork is far too much. I would appreciate a bot that could help me with anything – making sure I don't miss things that are due, completing asks from patients, answering messages."*
> – Family Physician

Implementation and Change Management

The development and implementation of the bot were affected by the compressed evaluation timeline and the distributed nature of primary care. Implementing a bot at each site requires sufficient time for change management to ensure compatibility with existing EMR systems, workflows, and staff preferences. Some PCPs reported that the learning curve and time investment required to integrate the bot into their workflows during the evaluation period was "secondary to [addressing other] administrative barriers, like documentation." PCPs felt that with more time, they would have had greater capacity to implement and manage the changes associated with integrating both an AI scribe and the bot into their practice.

5.0 Discussion

Key Findings

The implementation of AI scribes into a range of primary care practices across Ontario revealed numerous benefits for PCPs: reduced administrative burden, cognitive load, and afterhours work; improved efficiency and documentation practices; increased job satisfaction, professional fulfillment, and work-life balance; and perceived improvements in quality of care.

Variations in the underlying practice styles and preferences of PCPs also led to differential value propositions of AI scribes. For PCPs who struggled with completing medical notes in a timely manner, using an AI scribe enhanced completeness and quality of documentation. For PCPs who were diligent notetakers and often worked afterhours, AI scribes reduced workload. For others, AI scribes were valuable for reducing cognitive load, enabling PCPs to be more present during encounters; thus, improving the quality of care. Notably, these groups were not mutually exclusive, and nearly all PCPs benefited from reduced administrative burden and cognitive load, and both PCPs and patients reported improved engagement and rapport.

PCPs were also receptive to automating other tasks that contribute to their administrative workload, especially for time-consuming repetitive tasks that are driven by mouse-clicks and keystrokes. While some PCPs found the bot useful, others noted that the bot's task was too broad but would re-consider if it were more targeted, such as sending reminders for specific conditions that require routine follow-up. Importantly, implementing RPA solutions in a distributed primary care landscape requires significant effort to secure approvals and provide support on a site-by-site basis. However, developing, testing, and implementing RPA remains valuable to PCPs to ensure that workflow processes are continuously improving as administrative burden continues to pose a challenge.

Overall, evidence from both lab settings and real-world implementation demonstrate that AI scribes can reduce administrative burden, and PCPs see these as valuable tools and are willing to pay to continue to access them (albeit less than the current market price). To support long-term use of these tools, continuous improvements, such as seamless EMR integration, enhanced capabilities for equitable access, and personalized workflows, are necessary.

Study Limitations

Although methodologically rigorous data collection and synthesis activities were used to provide insights on the impact of AI scribes and RPA in primary care settings, there were some limitations. First, there is potential for volunteer bias as participants were actively seeking solutions to reduce their administrative burden and were more receptive to automated solutions, such as AI scribes and RPA. Moreover, approximately half of PCPs described themselves as expert EMR users, indicating high digital literacy, which may not be representative of all PCPs in Ontario.

In addition, participants were only given three and a half months to trial an AI scribe, and they may not have been motivated nor had sufficient time to learn all the functionalities and customizations of the tool or fully integrate it into their workflow. Thus, the perceived benefit and impact of AI scribes may be underestimated. In addition, data on time spent on patient care and administrative tasks were self-reported. Although data from the simulated encounters were consistent with the self-reported measures, observations in real-world settings are needed to validate these findings and determine the long-term impact of AI scribes and RPA on administrative burden.

Lastly, AI scribes and RPA are rapidly evolving, and these findings may not reflect updates made to the large language models, new features and functions developed, or the relative performance of these tools over time.

6.0   Conclusion

This clinical evaluation on the implementation of AI scribes in a range of primary care practices across Ontario revealed numerous benefits: a reduction in administrative burden, afterhours charting, and cognitive load for PCPs; more meaningful, engaging, and effective clinical interactions between PCPs and patients; and improved patient and provider satisfaction. In addition to using AI scribes, PCPs were also receptive to automation processes that could manage time-consuming, repetitive administrative tasks; thus, freeing up time for them to focus on other tasks that make better use of their medical expertise and skills. However, limitations of these technologies still exist. For AI scribes, their performance varies across clinical scenarios and there are ongoing concerns regarding equity, EMR integration, and data privacy and security. For RPA, only some PCPs perceived that the developed bot was useful and, more broadly, there are ongoing challenges with the implementation of RPA technology in a distributed primary care landscape. Overall, although AI scribes and RPA demonstrate potential to alleviate administrative burden for PCPs, ongoing evaluation is necessary to ensure that these technologies continue to support PCPs while also optimizing accuracy, effectiveness, and safety for both patients and providers.

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