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Original Article

Awareness and Perspectives on the Role of Artificial Intelligence in Primary Care: A Cross-Sectional Survey of Rural and Urban Primary Care Physicians in Alberta, Canada

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Abstract

Background: Artificial intelligence (AI) is increasingly integrated into healthcare, yet physicians' awareness and perspectives remain underexplored. While often associated with imaging, AI applications also include online scheduling, digitized records, virtual consultations, and drug dosage algorithms. This study surveyed Canadian primary care physicians (PCPs) to assess their awareness and attitudes toward AI in healthcare. **Methods:** A cross-sectional survey was distributed via email and newsletters to family physicians across Alberta, including both urban and rural settings. Responses were collected through Qualtrics. **Results:** Of 79 responses, 46 met inclusion criteria. Most respondents practiced in urban areas (63%) and had no prior AI training (65%). Rural physicians reported greater comfort and interest in AI, including its use for monitoring treatment adherence (p=0.043) and analyzing EMR data for health management (p=0.027). Knowledge of AI varied widely: only 30% recognized that deep learning involves artificial neural networks, while 44% reported no knowledge of the concept. Commonly used AI tools included ECG interpreters (65%) and language translators (37%). Physicians showed interest in expanded medical uses of AI. **Conclusion:** There is a lack of knowledge and use of AI tools in medicine, with both urban and rural physicians' responses suggesting a need for more education and training in AI. The "Lack of human connection" was the main fear that was expressed regarding the use of AI in healthcare suggesting concerns about potential impacts on patient-provider relationships. This survey's findings may inform future research into the development and implementation of AI in primary care.

Introduction

Artificial Intelligence (AI) has the potential to revolutionize the healthcare industry by overcoming barriers and improving efficiency.[1, 4] However, despite the advancements of AI applications in medicine, the attitudes and level of awareness among primary care providers (PCPs) remain unclear.[5, 7]

AI is already integrated into many aspects of healthcare. This ranges from administrative tasks such as appointment scheduling and digital recordkeeping to clinical decision support systems and diagnostic tools.[7, 9] AI will continue to play a critical role for physicians by assisting clinical decision-making, improving practice management, increasing diagnosis accuracy, and helping integrate new healthcare technologies. Some of the well-known examples of application of AI in medicine includes CAD (computer assisted diagnosis) for screening mammography, DXplain (decision support system by MIT), Babylon (UK based patient consulting system), Gremwatcher (infection detection system by University of Washington).[10, 12]

In primary care centers, AI-based technologies can be particularly beneficial as PCPs are responsible for the majority of patient-physician interactions and are the most accessed physician resource.[13] A study by Stewart and Ryan10 found that across the Canadian Provinces, 238 per 1000 individuals contacted their family physicians each month—more than other physician specialists. As AI continues to evolve, understanding PCPs' familiarity, concerns, and perceived benefits is essential to ensure appropriate and effective adoption.[5,14]

Few studies probing the awareness of AI knowledge among healthcare providers, or their attitude toward the increasing integration of AI in healthcare, have been conducted. One review of qualitative evidence reported that healthcare providers across several medical specialties had varied views on the topic, holding beliefs that AI could benefit clinical decision-making, but expressing skepticism and uncertainty about its effectiveness and mechanics.[15] Another review investigating the perspectives of

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radiologists on the topic showed optimism about AI in their field and a desire to learn more, but hesitancy about the degree to which it could be trusted without supervision.[16] Furthermore, the number of studies on PCPs has been more limited. A thematic analysis conducted on discussions among Canadian patients and PCPs highlighted perceived barriers to the implementation of AI in primary care.[2] Concerns included the readiness of existing health systems, the potential for bias, the necessary training, and the difficulty in designing user-friendly tools. It is worth noting that in the past, PCPs have been hesitant to adopt other technologies, such Electronic Medical Records (EMRs), due to similar concerns about accessibility and reliability.[3]

Canadian medical leaders have recently emphasized the importance of AI in healthcare, as seen with the implementation of the AI task force by the Royal College.[17] As well, the Government of Canada has implemented a comprehensive policy on digital health solutions to enhance healthcare delivery. The policy emphasizes interoperability, privacy, security of health information, ethical considerations, and the responsible use of emerging technologies, such as AI in healthcare. However, an assessment of urban and rural Canadian PCPs' knowledge, use, and attitude toward AI in healthcare is lacking.[18] Meanwhile, AI development is advancing rapidly and is offering more solutions that can be utilized by PCPs.

To our knowledge, no prior study has directly compared the perspectives of urban and rural Canadian PCPs on AI integration in primary care. In this study, we conducted a cross-sectional survey of PCPs practicing in Alberta, Canada, to evaluate their awareness, concerns, and interest in using AI in clinical practice. Alberta was selected as the study site due to the authors' affiliations with the University of Calgary and University of Alberta, and access to established physician networks. Currently, 5425 PCPs practice in Alberta, Canada.[19]

We recognize the importance of considering readiness for AI implementation in different practice environments, as rural and urban PCPs may have distinct needs and considerations.20 Rural communities often have been slower at adopting modern technologies, yet with the potential benefits of AI offers, rural physicians might have more to gain from its implementation.[21,22] At the same time, understanding the perspectives and concerns of urban PCPs is crucial, given their higher patient volume and established healthcare infrastructure.[23,24] By considering both rural and urban PCPs, we aim to inform future development in the area and bridge the gap between AI developers and end users for improved integration and efficacy of technology into primary practice.

Methods

This study is a cross-sectional survey of PCPs currently practicing family medicine in urban and rural healthcare centers in Alberta, Canada. The overall goal of this study was to gauge the readiness of family physicians about the use of artificially intelligent tools in their medical practice. The objectives of this study were two-fold. First, to assess PCPs' level of awareness and understanding of AI, and second, to gather their perspectives on the potential applications of AI in primary care.

Participants

Our target population was PCPs currently practicing in Alberta, Canada, as well as Family Medicine residents in any year of residency from the province's Family Medicine programs (the University of Calgary and the University of Alberta). Recruitment methods included emailing physicians through the College of Physicians and Surgeons of Alberta (CPSA) medical directory, advertising the survey through the Distributed Learning and Resource Initiatives (DLRI) newsletter at the University of Calgary Cumming School of Medicine, as well as through rural and urban Primary Care Network (PCN) newsletters throughout Alberta. Further, we utilized the local academic network at both the University of Calgary and Alberta, such as personally contacting PCP faculty members to distribute it amongst their networks. Upon survey completion, participants chose to be redirected to a page where they entered a draw for one of ten $50 Amazon gift cards.

Survey Design

Our research team outlined a list of specific objectives based on the aim of the project and gaps in the current literature. The survey has three primary components: 1) Participant demographics, notably, whether participants have previous knowledge of AI and whether their primary setting of practice is rural or urban Alberta; 2) Baseline knowledge of AI; 3) Assessment of attitudes towards AI, including fears associated with AI use in medicine, and personal comfort with the notion of future AI use in medicine.

A list of closed and open-ended questions was then designed for the survey based on these objectives. The closed-ended questions assessed participants' demographics, practice characteristics, current use of AI in their practice and perspectives on the potential use of AI in their practice. The open-ended questions used the Likert scale and narrative questions to assess participants' perspectives on the potential applications of AI in primary care, as well as their concerns and barriers to the adoption of AI in primary care. Questions assessing knowledge of AI topics were independently assessed for accuracy and validity by a professor of Computer Science with a specialization in data mining. The survey was pilot tested amongst the research team for clarity and ease of understanding before being distributed. The survey was hosted on Qualtrics (Qualtrics, Provo, UT).

Data Collection

Participants were given a link to the survey and were asked to complete it within a specific timeframe. The data contained no unique identifiers and was securely stored on secured drives with restricted access. Survey responses were collected from October 2022 to February 2023.

Data Analysis

We received a total of 79 survey responses. Of these, 44 were 100% complete, 2 were over 80% complete, and 33 were less than 20% complete. Per our inclusion criteria, survey responses that were less than 80% complete were excluded from the analysis. This resulted in 46 responses eligible for further statistical analysis, for an overall analyzable response rate of 58%. As a result, some variables may have a smaller number of observations, potentially affecting the generalizability and interpretation of subgroup comparisons.

Demographic data and Likert-scale responses were summarized using descriptive statistics, while open-ended questions were subjected to qualitative content analysis. We performed statistical comparisons of the responses between groups of PCPs including, by gender, by practice location and by length of practice using nonparametric techniques. We decided that nonparametric tests of hypothesis were more appropriate, given the limited number of participants who responded to our survey. For the comparisons involving two groups, we used Mann-Whitney U test, and for the comparison involving more than two groups, we used Kruskal-Wallis test. Data exported from Qualtrics was cleaned and processed in MS Excel in preparation for analysis. Statistical analyses were performed using IBM SPSS Statistics version 28.0.1. We worked with a significance level of 0.05 to determine statistical differences between groups. For other data not presented in the tables, we included as graphs which were created in MS Excel.

Ethics

The study received ethics clearance from the University of Calgary Conjoint Health Research Ethics Board (REB22-0132) based on the Tri-Council Policy Statement, ethical conduct for research involving humans (TCPS) in accordance with declaration of Helsinki. The survey responses were anonymous and confidential. Incentives such as a gift card raffle were given to encourage participation and to thank participants for their time. Attached to the survey invitation email was a survey a letter of information/implied consent form approved by the University of Calgary Conjoint Health Research Ethics Board which explained how consent would be obtained for the study. Informed consent to participate in the study was obtained from all the participants.

Results

Demographics

All participants were either licensed family medicine physicians or residents currently completing family medicine training. Of the 46 responses meeting inclusion criteria ***(Table 1).*** 29 participants worked primarily in urban settings and 17 in rural settings. Respondents spanned a wide range of age groups, with the largest proportion (30%) between 31–40 years old. When it comes to the setting of practice, the largest proportion of respondents worked in private practice (n=36). The smallest group worked in hospital outpatient settings (n=5). 35% of participants reported additional training in a Family Medicine Enhanced Skills area (i.e., specialized fellowship training after completing family medicine residency), and most (65%) had no prior training in AI.

Readiness for Use of AI in Medical Practice by Practice Location

Physicians from rural and urban locations were similar in almost all aspects of readiness for use of AI in medical practice, except for 2 areas. Two areas where statistical differences were noted were in the comfort level of using AI for monitoring patients to remain concordant with treatment (p=0.043) and for using the AI to analyze EMR data to guide health management (p=0.027). For both functionalities, physicians from rural areas indicated higher interest and level of comfort, than the doctors from urban locations. While it did not reach statistical significance, the rural doctors also were more interested to use virtual health assistant and other diagnostic tools if they were given the training to use these tools. Further, despite not being found statistically significant, it is notable that none of the rural physicians trusted AI to diagnose patients independently and neither do they trust AI to design treatment plans independently.

Readiness for Use of AI by Gender

As shown in ***Table 3,*** Male physicians were more trusting of AI in medical practice than female physicians and the difference was statistically significant (p=0.034). Similarly, male physicians were more interested than female physicians in using a virtual health assistant as a tool (p=0.042) and in using AI to assist in diagnosing patients with close supervision (p=0.028). Furthermore, there is weak evidence indicating that male doctors have interest in using AI for administrative work assistance (p=0.065) and other diagnostic tools (p=0.080). On the other hand, more female doctors would use a language translator tool (p=0.031). While statistically significant, it is important to note that male physicians did not trust AI to diagnose patients independently and nor did they trust AI to design treatment plans independently.

Readiness for Use of AI in Medical Practice by Length of Practice

There are no remarkable differences in responses among the 3 groups of physicians by length of practice ***(Table 4).*** While it was not found statistically significant, it is important to note that none of the physicians who have been in practice for more than 15 years trusted AI to diagnose patients independently or trusted AI to design treatment plans independently.

Knowledge of Physicians about Artificial Intelligence

Figure 1 combines responses from both rural and urban physicians. For each statement, most physicians were at least somewhat aware of these topics, however, there were differences in awareness depending on the AI statement. Among all physicians, the statement "AI is an interdisciplinary field that allows computers to mimic human intelligence" was the most familiar, with 67% of physicians being Familiar with it. The statements "AI systems are trained using existing data to do an automated predictive task" and "AI is an interdisciplinary field

Table 1. Demographic and Professional Characteristics of Participants (Rural vs. Urban).

Demographic Profile	Rural		Urban		Total	
	n	%	n	%	n	%
Participants	17	37	29	63	46	100
Age						
20-30 yrs	1	6	7	24	8	17
31-40 yrs	5	29	9	31	14	30
41-50 yrs	3	18	5	17	8	17
51-60 yrs	5	29	2	7	7	15
61+ yrs	3	18	6	21	9	20
Gender						
Male	11	65	11	38	22	48
Female	6	35	18	62	24	52
Length of Practice (years)						
0-5 yrs	3	18	10	34	13	28
6-10 yrs	4	24	5	17	9	20
11-15 yrs	3	18	5	17	8	17
16-20 yrs	2	12	1	3	3	7
20+ yrs	5	29	8	28	13	28
Practice Setting						
Private practice	11	65	25	86	36	78
Hospital outpatient	2	12	3	10	5	11
Hospital inpatient	4	24	1	3	5	11
Additional Medical Training						
No additional training	6	35	25	86	31	67
Addiction	0	0	1	3	1	2
Care of Elderly	0	0	1	3	1	2
Emergency Medicine	2	12	0	0	2	4
Family Medicine + Anesthesia	2	12	1	3	3	7
Maternal /Newborn Care	0	0	1	3	1	2
Palliative Care	2	12	1	3	3	7
Sport and Exercise Medicine	0	0	1	3	1	2
Other training	4	24	3	10	7	15
Previous AI Training						
No training	13	76	17	59	30	65
Self-taught	3	18	10	34	13	28
Online AI training	1	6	3	10	4	9
University course	1	6	1	3	2	4
Workshops	0	0	2	7	2	4

Legend: Survey Participant Demographics were grouped by whether the setting of primary practice for the physician was selected as urban (Edmonton or Calgary) or rural (all other locations). AI training includes online modules/courses, self-taught/readings, and workshops. yrs= years

that allows computers to mimic human intelligence" were also well-known, with more than 60% of physicians being familiar with them. On the other hand, statements related to subset concepts of AI (i.e., Deep Learning and Machine Learning) were the least familiar, such as the statement "Deep learning involves the use of artificial neural networks", with only 30% of physicians being familiar with it and 44% stating they had no knowledge.

Overall, physician awareness of AI was limited and varied depending on the concept.

Physicians' Use and Interest in AI Tools

Figure 2 highlights physicians' prior use and interest in AI tools. The most commonly used tools were ECG interpreters (65%) and language translators (37%). All other tools had not been used by more than 80% of respondents. Despite limited prior exposure, most respondents expressed interest in adopting AI tools in their practice—particularly for administrative workflow support (80%) and visual diagnostic assistance (78%). Virtual health assistants, however, drew comparatively less interest (48%), even though this trend was not statistically significant.

Discussion

This study presents the results of a survey of urban and rural primary care physicians in Alberta, Canada, aimed at assessing their awareness and perspectives on the role of artificial intelligence (AI) in primary care. The use of AI in healthcare is a rapidly growing field with the potential to improve patient outcomes and reduce healthcare costs. However, there is a need to understand the perspectives and attitudes of primary care physicians toward the integration of AI in their practice. The survey results reported in this study provide a snapshot of the current state of primary care physicians' knowledge and attitudes toward AI and highlight areas where education and training may be needed to facilitate the integration of AI in primary care.

When asked whether the participants have used any of the AI tools listed, most of the respondents said that they had never heard of them while the vast majority expressed interest in using them were they available. This highlights a key gap between awareness and interest, indicating an opportunity for targeted education. Further, the results show that the majority of physicians have not had prior AI training, with a higher percentage of rural physicians (76%) reporting no prior AI training compared to urban physicians (59%). Regarding knowledge and awareness, overall physicians showed varying levels of knowledge and awareness of AI concepts, with some concepts being more well-known than others ***(Figure 1).*** A potential reason for this unfamiliarity could stem from lack of exposure to and awareness of current technological advancements. This is evident in that up to 85% of respondents said they would use the mentioned AI tools, such as a language translator and an ECG interpreter, were they available to them ***(Figure 2).*** This suggests that there is a potential for greater adoption of AI in healthcare, but education and training may be necessary to increase familiarity and comfort with these tools. Future studies may also explore why physicians may value certain AI tools over others.

Comparing perspectives of urban and rural physicians, more rural physicians reported being trusting of AI's use in medicine than their urban counterparts ***(Table 2).*** Although it is unclear why this difference may exist, it is important to interpret these results with caution, as no statistical differences were found and the relatively small sample size of rural physicians in the survey (34%, n=15) may limit the generalizability of these findings. This difference could stem from variation in perceived workload, resource availability, or openness to workflow assistance, but remains exploratory. Albeit, both groups had similar reservations regarding its use and efficacy, with lack of human connection being the most common reported fear.

Table 2. Readiness for Use of AI in Medical Practice by Practice Location.

Readiness of Physicians for Use of AI in Medical Practice by Practice Location.	Practice Location						P-Value*
	Rural		Urban		Total		
	n	%	n	%	n	%	
Participants	17	37	29	63	46	100	
Familiarity with AI							
No knowledge	3	18	6	21	9	20	
Vaguely aware	9	53	12	41	21	46	0.768
Familiar	5	29	11	38	16	35	
Familiarity with Medical Use of AI							
No knowledge	3	18	9	31	12	26	
Vaguely aware	10	59	11	38	21	46	0.807
Familiar	4	24	9	31	13	28	
Have used technologies that use AI in my medical practice							
No	11	65	21	72	32	70	
Maybe	4	24	4	14	8	17	0.673
Yes	2	12	4	14	6	13	
Currently using Artificially Intelligent tools in my medical practice							
No	11	65	22	76	33	72	
Maybe	4	24	3	10	7	15	0.517
Yes	2	12	4	14	6	13	
Have used AI tools in my medical practice							
Virtual Health Assistant	1	6	2	7	3	7	0.894
Language Translator	8	47	9	31	17	37	0.282
Administrative Workflow Assistance	2	12	4	14	6	13	0.845
ECG Interpreter	10	59	20	69	30	65	0.491
Visual diagnostic tools	1	6	5	17	6	13	0.275
Other diagnostic tools that use AI	2	12	6	21	8	17	0.496
Given training, I would use AI tools in my medical practice							
Virtual Health Assistant	11	65	11	38	22	48	0.083
Language Translator	14	82	25	86	39	85	0.728
Administrative Workflow Assistance	14	82	23	79	37	80	0.804
ECG Interpreter	16	94	23	79	39	85	0.182
Visual diagnostic tools	15	88	21	72	36	78	0.214
Other diagnostic tools that use AI	15	88	19	66	34	74	0.094
Would be comfortable if AI tools was used in my practice to:							
Guide patients through administrative operations in my office	11	65	23	79	34	74	0.684
Assist with medical billing and coding	13	76	23	79	36	78	0.605
Assist with writing referral letters to specialist physicians	12	71	20	69	32	70	0.341
Assist in diagnosing patients with my close supervision	6	35	11	38	17	37	0.343
Diagnose patients independently	0	0	2	7	2	4	0.912
Assist with designing treatment plans with my close supervision	6	35	9	31	15	33	0.317
Design treatment plans independently	0	0	2	7	2	4	0.760
Monitor patients to remain concordant with treatment plans	11	65	11	38	22	48	**0.043**
Analyze patient EMR data to guide health management between visits	15	88	21	72	36	78	**0.027**
Would trust AI in my medical practice							
Probably not	5	29	15	52	20	43	
Probably yes	10	59	14	48	24	52	0.251
No response	2	12	0	0	2	4	
Concerns about trusting AI in my medical practice							
Fear of AI taking over my job	2	12	4	14	6	13	0.845
Fear of the unknown	4	24	6	21	10	22	0.824
Lack of human connection	8	47	14	48	22	48	0.937
Lack of understanding	4	24	11	38	15	33	0.320

Legend: * p-value based on Mann-Whitney U test. The prompt in the survey was "I would be comfortable if AI was used in my practice to..." followed by several statements displayed in the table.

Table 3. Readiness for Use of AI in Medical Practice by Gender.

Readiness for Use of AI in Medical Practice by Gender.	Gender						P-Value*
	Male		Female		Total		
	n	%	n	%	n	%	
Participants	22	48	24	52	46	100	
Familiarity with AI							
No knowledge	4	18	5	21	9	20	
Vaguely aware	10	45	11	46	21	46	0.794
Familiar	8	36	8	33	16	35	
Familiarity with Medical Use of AI							
No knowledge	6	27	6	25	12	26	
Vaguely aware	7	32	14	58	21	46	0.309
Familiar	9	41	4	17	13	28	
Have used technologies that use AI in my medical practice							
No	15	68	17	71	32	70	
Maybe	3	14	5	21	8	17	0.704
Yes	4	18	2	8	6	13	
Currently using Artificially Intelligent tools in my medical practice							
No	16	73	17	71	33	72	
Maybe	4	18	3	13	7	15	0.781
Yes	2	9	4	17	6	13	
Have used AI tools in my medical practice							
Virtual Health Assistant	1	5	2	8	3	7	0.607
Language Translator	7	32	10	42	17	37	0.494
Administrative Workflow Assistance	5	23	1	4	6	13	0.065
ECG Interpreter	14	64	16	67	30	65	0.831
Visual diagnostic tools	4	18	2	8	6	13	0.327
Other diagnostic tools that use AI	6	27	2	8	8	17	0.080
Given training, I would use AI tools in my medical practice							
Virtual Health Assistant	14	64	8	33	22	48	**0.042**
Language Translator	16	73	23	96	39	85	**0.031**
Administrative Workflow Assistance	19	86	18	75	37	80	0.337
ECG Interpreter	19	86	20	83	39	85	0.777
Visual diagnostic tools	18	82	18	75	36	78	0.580
Other diagnostic tools that use AI	18	82	16	67	34	74	0.248
Would be comfortable if AI tools was used in my practice							
Guide patients through administrative operations in my office	14	64	20	83	34	74	0.119
Assist with medical billing and coding	18	82	18	75	36	78	0.551
Assist with writing referral letters to specialist physicians	17	77	15	63	32	70	0.166
Assist in diagnosing patients with my close supervision	11	50	6	25	17	37	**0.028**
Diagnose patients independently	0	0	2	8	2	4	1.000
Assist with designing treatment plans with my close supervision	9	41	6	25	15	33	0.305
Design treatment plans independently	0	0	2	8	2	4	0.499
Monitor patients to remain concordant with treatment plans	13	59	9	38	22	48	0.192
Analyze patient EMR data to guide health management between visits	16	73	20	83	36	78	0.431
Would trust AI in my medical practice							
Probably not	6	27	14	58	20	43	
Probably yes	15	68	9	38	24	52	**0.034**
No response	1	5	1	4	2	4	
Concerns about trusting AI in my medical practice							
Fear of AI taking over my job	3	14	3	13	6	13	0.910
Fear of the unknown	6	27	4	17	10	22	0.389
Lack of human connection	8	36	14	58	22	48	0.141
Lack of understanding	6	27	9	38	15	33	0.465

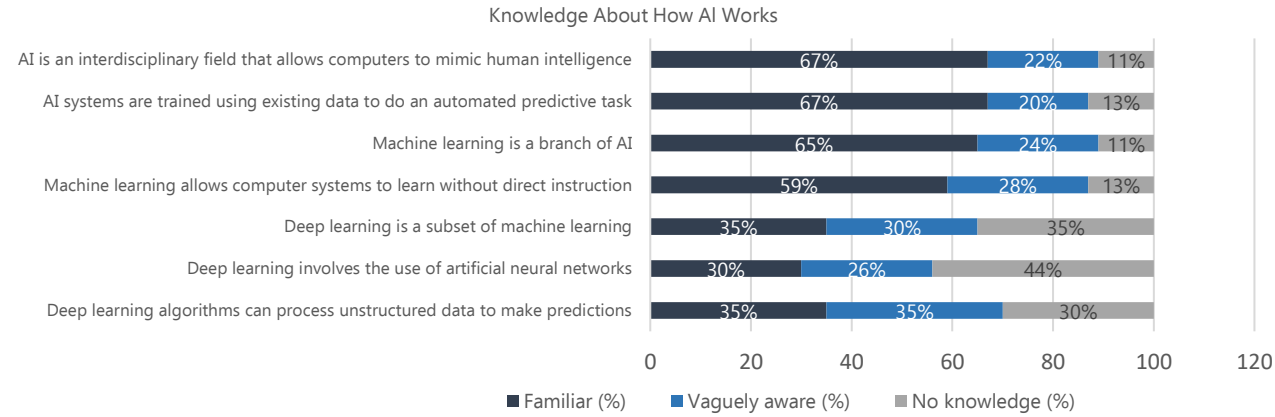
Legend: * p-value based on Mann-Whitney U test. The prompt in the survey was "I would be comfortable if AI was used in my practice to..." followed by several statements displayed in the table.

Table 4. Readiness for Use of AI in Medical Practice by Gender.

Readiness of Physicians for Use of AI in Medical Practice by Length of Practice.	Length of Practice						Total		P-Value*
	0-5 yrs		6-15 yrs		15+ yrs				
	n	%	n	%	n	%	n	%	
Participants	13	28	17	37	16	35	46	100	
Familiarity with AI									
No knowledge	2	15	3	18	4	25	9	20	
Vaguely aware	9	69	8	47	4	25	21	46	0.557
Familiar	2	15	6	35	8	50	16	35	
Familiarity with Medical Use of AI								0	
No knowledge	4	31	3	18	5	31	12	26	
Vaguely aware	8	62	8	47	5	31	21	46	0.316
Familiar	1	8	6	35	6	38	13	28	
Have used technologies that use AI in my medical practice								0%	
No	9	69	13	76	10	63	32	70	
Maybe	2	15	3	18	3	19	8	17	0.619
Yes	2	15	1	6	3	19	6	13	
Currently using Artificially Intelligent tools in my medical practice									
No	10	77	12	71	11	69	33	72	
Maybe	0	0	4	24	3	19	7	15	0.965
Yes	3	23	1	6	2	13	6	13	
Have used AI tools in my medical practice									
Virtual Health Assistant	1	8	0	0	2	13	3	7	0.349
Language Translator	5	38	5	29	7	44	17	37	0.695
Administrative Workflow Assistance	2	15	2	12	2	13	6	13	0.956
ECG Interpreter	11	85	11	65	8	50	30	65	0.157
Visual diagnostic tools	3	23	1	6	2	13	6	13	0.390
Other diagnostic tools that use AI	2	15	2	12	4	25	8	17	0.534
Given training, I would use AI tools in my medical practice									
Virtual Health Assistant	5	38	10	59	7	44	22	48	0.507
Language Translator	11	85	14	82	14	88	39	85	0.920
Administrative Workflow Assistance	11	85	14	82	12	75	37	80	0.789
ECG Interpreter	10	77	15	88	14	88	39	85	0.653
Visual diagnostic tools	12	92	14	82	10	63	36	78	0.141
Other diagnostic tools that use AI	9	69	14	82	11	69	34	74	0.614
Would be comfortable if AI tools was used in my practice									
Guide patients through administrative operations in my office	8	62	13	76	13	81	34	74	0.769
Assist with medical billing and coding	9	69	14	82	13	81	36	78	0.997
Assist with writing referral letters to specialist physicians	6	46	15	88	11	69	32	70	0.093
Assist in diagnosing patients with my close supervision	4	31	6	35	7	44	17	37	0.832
Diagnose patients independently	2	15	0	0	0	0	2	4	0.201
Assist with designing treatment plans with my close supervision	3	23	8	47	4	25	15	33	0.364
Design treatment plans independently	2	15	0	0	0	0	2	4	0.678
Monitor patients to remain concordant with treatment plans	6	46	10	59	6	38	22	48	0.556
Analyze patient EMR data to guide health management between visits	9	69	15	88	12	75	36	78	0.662
Would trust AI in my medical practice									
Probably not	6	46	5	29	9	56	20	43	
Probably yes	5	38	12	71	7	44	24	52	0.244
No response	2	15	0	0	0	0	2	4	
Concerns about trusting AI in my medical practice									
Fear of AI taking over my job	2	15	4	24	0	0	6	13	0.134
Fear of the unknown	4	31	3	18	3	19	10	22	0.652
Lack of human connection	8	62	6	35	8	50	22	48	0.362
Lack of understanding	6	46	4	24	5	31	15	33	0.428

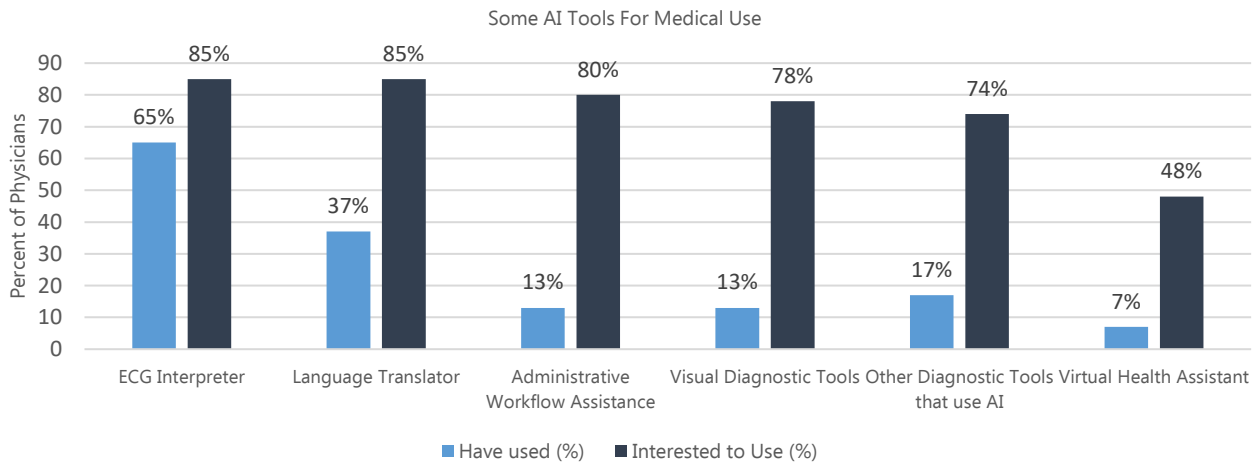
Legend: T* p-value based on Kruskal-Wallis test. he prompt in the survey was "I would be comfortable if AI was used in my practice to..." followed by several statements displayed in the table.

Figure 1. Knowledge of physicians about Artificial Intelligence.



Legend: Awareness and previous personal knowledge of artificial intelligence among survey participants. Q1: Deep learning involves the use of artificial neural networks; Q2: Deep learning is a subset of machine learning; Q3: Deep learning algorithms can process unstructured data to make predictions; Q4: Machine learning allows computer systems to learn without direct instruction; Q5: AI system are trained using existing data to do an automated predictive task; Q6: AI is an interdisciplinary field that allows computers to mimic human intelligence; Q7: Machine learning is a branch of AI.

Figure 2. Physicians' Interest in Artificially Intelligent Tools for Medical Use.



Legend: Use and interest of artificially intelligent tools among survey participants. From a non-exhaustive list of Artificial Intelligence's uses in medicine, the survey question asks, "have you personally used any of the tools listed?" From a non-exhaustive list of Artificial Intelligence's uses in medicine and assuming appropriate training was given, the survey question asks, "would you use the tools listed if they were available at your workplace or place of practice?"

Physicians' fears regarding AI use in medicine were centred around the lack of human connection, lack of understanding, and fear of the unknown, with fear of lack of human connection being the largest concern overall (48%) ***(Table 2).*** Lack of human connection has always been a fear regarding the use of AI in healthcare.[5] This fear often arises because providers are not aware of where and how AI can fit into their workflow. For instance, some of the tools that were presented in the study such as the ECG interpreter or administrative workflow assistance would not affect the doctor-patient appointment and would rather optimize tasks that must happen before the patient even arrives, potentially freeing up physicians to spend more time with patients.

Other concerns included reliability, where physicians feared the possibility of misdiagnoses and unawareness of internal algorithms and functions. These findings are similar to concerns brought up by other Canadian and English healthcare professionals.[6,7] AI becomes especially problematic when physicians become overly dependent on AI and could miss out on wrongful outputs, simply because of automation bias.[8] These concerns underscore the importance of ensuring transparency in AI design and physician education around the limitations of AI.

These issues lead to key legal questions that arise when challenged by potential medical malpractice as a result of technology, which our current legal systems fall short of and focus on legal principles that are concentrated on human behaviour, which fail to function when applied to AI.[6,9] A potential policy recommendation is to consider AI as an independent person under the law. This means that the AI system can be sued for any acts of negligence and as such will be required to be

insured. The insurance provided will be similar to how physicians can engage in medical malpractice, and claims will be paid directly from their insurance. A major benefit of this policy is that it focuses beyond the manufacturer of AI and urges users to be liable for their decision of using this technology in their facility. However, it is important to consider that it is currently unclear whether AI technologies can be trialled independently.[9]

Aspects of fear and lack of awareness can stem from insufficient exposure to AI during and after training, which can be tackled through a variety of different means.[13,14] Firstly, the introduction of career development courses, offered through conferences, for instance, can provide exposure and a learning opportunity to physicians about modern technology that can help their workflow. These workshops can be led by teams of developers and physicians who are well-acquainted with the tools. The goals of these workshops would be to train physicians on how to use AI tools, how to input information for optimized results and efficiency, and thoroughly learn the benefits and risks associated with AI. These training sessions could educate physicians on how the algorithms function to reduce physician anxiety, establish trust in AI, and reduce patient harm.

Furthermore, the introduction of an AI education block or incorporated teaching through medical school or the family medicine residency program is another potential solution. A report by the College of Family Physicians of Canada proposed an extension of the length of family medicine residency training to three years to enhance their medical education to better meet the needs of the population.[15] This extra year may provide an opportunity to integrate some AI training into the program without reducing clinical hours to better prepare new graduates. Additionally, there is also an ongoing discussion on implementing Digital health literacy competencies into the CanMEDS Framework.[16] These system-level curriculum changes may help normalize AI literacy early in physician training. As the revolution of AI in medicine continues, there will be multiple conversations on how to implement AI into the medical school curriculum.[18] These will be important implementations to consider as AI continues to become more integrated into society.

Limitations

While the survey results provide insight into the perceptions of primary care physicians on AI and its use in healthcare, there are limitations to the study. The study only received 79 physician responses, out of which only 46 responses were analyzable, resulting in a small sample size. All respondents were working in primary care, with a majority working in private practices (78%, n=36). This may limit the generalizability of the study's findings to the larger population of physicians, especially those working in other settings, such as community health centers or academic medical centers. Rural physicians made up only 37% (n=17) of the respondents further limiting the study's generalizability.

The analyzable response rate of 58% indicates that a significant proportion of the physicians who received the survey did not respond or did not complete it fully. Also, since this survey was a voluntary survey shared through email, it may have drawn the interest of physicians who already have some interest in AI. This raises questions about the representativeness of the sample. Furthermore, the survey relied on self-reported data, which may be subject to recall bias or social desirability bias. For example, physicians may have overreported their knowledge of AI or may not have accurately recalled their training and work environments. Moreover, the study did not collect data on the race or ethnicity of the participants, which could be important factors in shaping their perspectives on AI in medicine. Therefore, the study's findings should be interpreted with caution and further research is needed to better understand the role of AI in primary practice.

Conclusion

Overall, these results suggest that there is a lack of knowledge and use of AI tools in medicine, with both urban and rural physicians' responses suggesting a need for more education and training in AI. There is a high level of interest in using AI to assist with administrative and clerical tasks, moderate interest in using AI to assist with diagnosis and low interest in using AI to independently diagnose or develop treatment plans. Gender-based differences in AI trust were observed, with male physicians less likely than female physicians to trust AI to function independently; these findings remain exploratory and warrant further research.

Given the strong interest expressed by respondents, we suggest the development of structured continuing professional development modules on AI, particularly those tailored to the needs of primary care physicians. These could include hands-on sessions focused on interpreting AI outputs, understanding risks and limitations, and aligning tools with existing workflows.

The data showed broad interest in AI and readiness to use AI among PCPs across a wide variety of demographic variables including gender, rural/urban, age and experience. It is unclear whether there are differences between urban and rural physicians. However, with AI in medicine being advertised as providing tailored solutions, it is important to consider the differences between urban and rural practices. Further research should focus on developing and implementing AI education and training programs for physicians, taking into account the perspectives of these key stakeholders. AI technology has the potential to benefit practice broadly but may have the most to offer in resource limited settings like in the rural environment. Integration of new technology in medical practice has typically started in well-resourced settings and moved outwards towards more resource limited settings such as rural environments. This data set, showing similar interest, experience and readiness between urban and rural settings suggests that it may be possible to integrate and study AI technology in rural environments at an early phase.

This survey's findings may inform future research into the development and implementation of AI in primary care. This includes identifying potential areas where AI can improve primary care delivery, as well as identifying potential barriers to the adoption of AI in primary care. The results of this survey can

inform the development of interventions to increase PCPs' awareness and understanding of AI and to support the integration of AI in primary care practice. As well, the survey results provide valuable information for policymakers, healthcare administrators, and researchers interested in understanding the current state of PCPs' knowledge and attitudes toward AI, and how it may be used to improve the delivery of primary care services.

This project began bridging the gap between PCPs and those at the forefront of AI development to highlight any shortcomings in the primary care healthcare system. Perspectives and ideas gathered from PCPs can help guide future AI applications to be more useful and relevant. Greater collaboration between clinicians, educators, and technologists will be critical to ensure that AI innovations are responsive to real-world clinical needs.

Summary – Accelerating Translation

Title: Awareness and Perspectives on the Role of Artificial Intelligence in Primary Care: A Cross-Sectional Survey of Rural and Urban Primary Care Physicians in Alberta, Canada

Main Problem to Solve

Artificial intelligence (AI) is changing healthcare in many ways, from helping with appointment scheduling and paperwork to supporting doctors in making diagnoses. Despite its growing use, we don't know much about how primary care physicians—especially those in rural versus urban areas—feel about AI or how familiar they are with it. Understanding their awareness and opinions is essential to successfully introducing AI into everyday medical practice.

Aim of the Study

This study aimed to understand how primary care physicians across Alberta, Canada—both in rural and urban settings—perceive and understand artificial intelligence. Specifically, the study looked at their knowledge of AI, how they've used it, how comfortable they feel using it, and what kinds of AI tools they'd be willing to use in the future.

Methodology

Researchers conducted a survey with family physicians and family medicine residents in Alberta. The survey was shared through professional newsletters, direct emails, and physician networks connected to the University of Calgary and the University of Alberta. It asked questions about physicians' background, familiarity with AI, and their opinions on different AI tools and applications in healthcare. A total of 79 responses were received, and 46 met the criteria to be included in the analysis.

Results:

Physicians of various ages and experience levels responded. Most (63%) were from urban areas, while 37% were from rural areas. About two-thirds (65%) had no previous training in AI. Interestingly, rural physicians reported feeling more comfortable using AI in specific tasks, such as monitoring treatment adherence and analyzing electronic medical records.

While most physicians had not used many AI tools, the tools they were most familiar with were ECG (heart monitor) interpreters and language translators. Even with limited experience, there was high interest in using AI for tasks like organizing workflow (80%) and visual diagnostic tools (78%).

When asked about their knowledge of AI, most physicians had a basic understanding, but many were unfamiliar with more technical aspects like machine learning and deep learning.

The survey also revealed some gender-based differences. Male physicians were generally more trusting of AI, especially in supporting diagnosis, while female physicians showed more interest in using AI for translation services. However, regardless of gender, few physicians trusted AI to make decisions independently, such as diagnosing patients or creating treatment plans.

Conclusion

This study shows that while many primary care physicians in Alberta are interested in using AI, most lack formal training and are unfamiliar with the technology, particularly its more advanced forms. Rural physicians were slightly more open to using AI than urban physicians, suggesting that AI might offer special value in settings with limited resources.

Doctors' biggest concern was that AI might harm the human connection between patients and physicians. They also worried about not fully understanding how AI tools work, and whether the tools could be trusted to make accurate decisions.

To help doctors feel more confident and better prepared to use AI, the study recommends creating targeted training programs. These could include hands-on workshops or continuing professional development (CPD) modules that show physicians how AI tools function and how they can fit into day-to-day practice. In the long term, introducing AI-related topics in medical school and residency could also help future doctors become more comfortable with these technologies.

Ultimately, this research is an important first step in making sure AI is introduced into primary care in a way that supports both doctors and patients. It encourages healthcare leaders, educators, and developers to work together with physicians to create tools that are trustworthy, easy to use, and tailored to the real needs of primary care settings.

References

1. Johnson KW, Torres SJ, Glicksberg BS, Shameer K, Miotto R, Ali M, et al. Artificial Intelligence in Cardiology. J Am Coll Cardiol. 2018 Jun 12;71(23):2668–79.
2. Tang A, Tam R, Cadrin-Chênevert A, Guest W, Chong J, Barfett J, et al. Canadian Association of Radiologists White Paper on Artificial Intelligence in Radiology. Can Assoc Radiol J. 2018 May 1;69(2):120–35.
3. Avati A, Jung K, Harman S, Downing L, Ng A, Shah NH. Improving palliative care with deep learning. BMC Med Inform Decis Mak. 2018 Dec 12;18(Suppl 4):122.
4. Schwab K, Nguyen D, Ungab G, Feld G, Maisel AS, Than M, et al. Artificial intelligence MacHIne learning for the detection and treatment of atrial fibrillation guidelines in the emergency department setting (AIM HIGHER): Assessing a machine learning clinical decision support tool to detect and treat non-valvular atrial fibrillation in the emergency department. J Am Coll Emerg Physicians Open. 2021 Aug;2(4):e12534.

5. Kassam A, Kassam N. Artificial intelligence in healthcare: A Canadian context. Healthc Manage Forum. 2020 Jan 1;33(1):5–9.
6. Waymel Q, Badr S, Demondion X, Cotten A, Jacques T. Impact of the rise of artificial intelligence in radiology: What do radiologists think? Diagn Interv Imaging. 2019 Jun 1;100(6):327–36.
7. Kueper JK, Terry AL, Zwarenstein M, Lizotte DJ. Artificial Intelligence and Primary Care Research: A Scoping Review. Ann Fam Med. 2020 May;18(3):250–8.
8. Lin S. A Clinician's Guide to Artificial Intelligence (AI): Why and How Primary Care Should Lead the Health Care AI Revolution. J Am Board Fam Med. 2022 Jan 1;35(1):175–84.
9. Amisha null, Malik P, Pathania M, Rathaur VK. Overview of artificial intelligence in medicine. J Fam Med Prim Care. 2019 Jul;8(7):2328–31.
10. Fenton JJ, Taplin SH, Carney PA, Abraham L, Sickles EA, D'Orsi C, et al. Influence of computer-aided detection on performance of screening mammography. N Engl J Med. 2007 Apr 5;356(14):1399–409.
11. London S. DXplain: a Web-based diagnostic decision support system for medical students. Med Ref Serv Q. 1998;17(2):17–28.
12. Kahn MG, Steib SA, Fraser VJ, Dunagan WC. An expert system for culture-based infection control surveillance. Proc Symp Comput Appl Med Care. 1993;171–5.
13. Stewart M, Ryan B. Ecology of health care in Canada. Can Fam Physician. 2015 May;61(5):449–53.
14. Liyanage H, Liaw ST, Jonnagaddala J, Schreiber R, Kuziemsky C, Terry AL, et al. Artificial Intelligence in Primary Health Care: Perceptions, Issues, and Challenges. Yearb Med Inform. 2019 Aug;28(1):41–6.
15. Hogg HDJ, Al-Zubaidy M, Technology Enhanced Macular Services Study Reference Group, Talks J, Denniston AK, Kelly CJ, et al. Stakeholder Perspectives of Clinical Artificial Intelligence Implementation: Systematic Review of Qualitative Evidence. J Med Internet Res. 2023 Jan 10;25:e39742.
16. Santomartino SM, Yi PH. Systematic Review of Radiologist and Medical Student Attitudes on the Role and Impact of AI in Radiology. Acad Radiol. 2022 Jan 29;S1076-6332(21)00624-3.
17. Artificial intelligence (AI) and emerging digital technologies :: The Royal College of Physicians and Surgeons of Canada [Internet]. [cited 2023 Mar 11]. Available from: https://www.royalcollege.ca/rcsite/health-policy/initiatives/ai-task-force-e
18. Teng M, Singla R, Yau O, Lamoureux D, Gupta A, Hu Z, et al. Health Care Students' Perspectives on Artificial Intelligence: Countrywide Survey in Canada. JMIR Med Educ. 2022 Jan 31;8(1):e33390.
19. Number of Physicians by Specialty Within Alberta Health Services Geographic Zones - Open Government [Internet]. [cited 2023 Jul 10]. Available from: https://open.alberta.ca/opendata/number-of-physicians-by-specialty-within-alberta-health-services-geographic-zones
20. Kirby JB, Yabroff KR. Rural–Urban Differences in Access to Primary Care: Beyond the Usual Source of Care Provider. Am J Prev Med. 2020 Jan 1;58(1):89–96.
21. Butzner M, Cuffee Y. Telehealth Interventions and Outcomes Across Rural Communities in the United States: Narrative Review. J Med Internet Res. 2021 Aug 26;23(8):e29575.
22. Buyting R, Melville S, Chatur H, White CW, Légaré JF, Lutchmedial S, et al. Virtual Care With Digital Technologies for Rural Canadians Living With Cardiovascular Disease. CJC Open. 2022 Feb 1;4(2):133–47.
23. Wong TY, Sabanayagam C. Strategies to Tackle the Global Burden of Diabetic Retinopathy: From Epidemiology to Artificial Intelligence. Ophthalmologica. 2019 Aug 13;243(1):9–20.
24. He J, Baxter SL, Xu J, Xu J, Zhou X, Zhang K. The practical implementation of artificial intelligence technologies in medicine. Nat Med. 2019 Jan;25(1):30–6.

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Conflict of Interest Statement & Funding

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Author Contributions

All authors conceptualized and designed the study, collected the data, conducted the analyses, and drafted and revised the initial manuscript. All authors contributed to the article and approved the submitted version.

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