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Original Research

Knowledge is not all you need for comfort in use of AI in healthcare

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ABSTRACT

Objectives: The adoption of artificial intelligence (AI) in healthcare is rapidly expanding, transforming areas such as diagnostics, drug discovery, and patient monitoring. Despite these advances, public perceptions of AI in healthcare, particularly in Canada, remain underexplored. This study investigates the relationship between Canadians' knowledge, comfort, and trust in AI, focusing on key sociodemographic factors like age, gender, education, and income.
Study design: Cross-sectional study.
Methods: Using data from the 2021 Canadian Digital Health Survey of 12,052 respondents, we employed ordinal logistic and multivariate polynomial regression analyses to uncover trends and disparities.
Results: Findings reveal that women and older adults consistently report lower levels of knowledge and comfort with AI, with middle-aged women expressing the most significant discomfort. Comfort levels are closely tied to concerns over data privacy, especially regarding the use of identifiable personal health data. Healthcare professionals exhibited heightened discomfort with AI, indicating potential issues with trust in AI's reliability and ethical governance.
Conclusions: Our results underscore that increasing knowledge alone does not necessarily lead to greater comfort with AI in healthcare. Addressing public concerns through robust data governance, transparency, and inclusive AI design is essential to fostering trust and successful integration of AI in healthcare systems.

1. Introduction

The application of AI in healthcare has received significant global interest and enthusiasm in recent years. Its application is already widespread and spans areas as diverse as drug discovery[1] and dentistry.[2] AI tools such as ChatGPT have fueled this popularity and the development of use cases around its application in healthcare has been swift and broad.[3–5] The benefits of implementing AI in healthcare are substantial, both changing the way medicine is practiced and reducing healthcare costs.[6,7] Within Canada, AI tools are already being used in healthcare for various functions, such as early patient warning systems to predict clinical deterioration, emergency department volume forecasting, and brain bleed detection.[8,9] There have been multiple studies on the attitudes of healthcare professionals toward AI, however, little is known about the general public's perception of AI within the healthcare setting as there is a dearth of research in this area.

There are two published reports assessing knowledge, comfort, and perceptions of AI in healthcare using data from the 2021 Canadian Digital Health Survey (CDHS).[10,11] It reported on the findings based on province, age, and region, but did not analyze the interactions between them. While age may be an important factor in understanding Canadians' attitudes towards AI, other socioeconomic and demographic factors, such as gender, education and income, may also play a role. As a result, it is important to understand the attitudes and perceptions of a range of Canadians towards AI technologies and how those attitudes differ based on the interactions of various social and demographic factors before developing ways to optimize patient adoption of AI tools in healthcare.

Familiarity with AI can increase comfort by reducing uncertainty;[12] however, it can also lead to discomfort as people become aware of potential issues, such as AI automating tasks they perform[12] or using their data for training.[13] Without efforts to educate and build comfort,

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particularly among vulnerable populations, an "AI divide" may emerge, similar to past digital divides. While knowledge is important, it is not enough to ensure comfort; social, economic, and cultural factors are also influential.[14,15] Effective, transparent, and accountable governance is essential to reassure the public about data safety and foster trust as AI continues to reshape healthcare.[16,17]

Comfort with AI also depends on the perceived benefits and trustworthiness of the technology. Familiarity with tools like ChatGPT has been shown to increase expectations of its benefits in healthcare.[18] Trust is crucial for adoption; patients need assurance that their data is safe, and breaches or algorithmic bias can erode this trust. Today's healthcare system faces numerous challenges to trust, including data security, misinformation, and potential misuse of AI.[19]

As the Canadian government continues to invest heavily in AI research, it is crucial to understand how AI technologies can be implemented and successfully adopted by end users in the healthcare setting, especially amongst historically marginalized populations and those who have traditionally been left behind. In this paper, we analyze data from the 2021 CDHS commissioned by Canada Health Infoway, focusing on questions about the knowledge and comfort of Canadians (based on age, gender, education and income) with using AI in healthcare. We identified gaps in knowledge and comfort that Canadians have with the use of AI in healthcare and make recommendations on how to address them.

2. Methods

2.1. Recruitment and data collection

Data was obtained from the 2021 CDHS, a cross-sectional survey of 12,052 Canadians over 16 years of age. It was commissioned by Canada Health Infoway and conducted by Leger via computer-assisted web interviewing technology (CAWI). The data was collected between July 14 to August 6, 2021.

The CDHS collected data on attitudes, utilization, perceptions, and expectations of digital health services in Canada. Survey participants were selected from the Leger Opinion panel, a group of 500,000 randomly selected representative panelists from all regions of Canada. The survey was available to the respondents in either English or French.[20]

2.2. Measures

The following questions were used to assess the attitudes and comfort level of respondents towards the use of AI in the healthcare setting:

- Q1 - On a scale of 1–4 with 1 being not at all knowledgeable and 4 being very knowledgeable, How knowledgeable are you about what artificial intelligence is?
- Q2 - On a scale of 1–4 with 1 being very uncomfortable and 4 being very comfortable: AI has major potential when used in healthcare because it can rapidly process vast amounts of information. How comfortable are you with AI being used as a tool in healthcare?
- Q3 - How comfortable are you with scientists using personal health data for AI research as long as informed consent has been provided by the patient?
- Q4 - How comfortable are you with scientists using personal health data for AI research without informed consent as long as it is deidentified (i.e., personal information such as name, date of birth has been removed)?

2.3. Independent variable

The four independent variables used in this study included age, gender, highest level of education attained, and household income. Age was calculated as the difference between a respondent's birth year and the survey date.

Data points were excluded from the analyses if a respondent answered "Prefer not to answer" for the household income question and/or "Other," "None of the above," or "Prefer not to answer" for the highest level of education obtained question.

2.4. Outcome (dependent) variable

The dependent variables included the respondent's self-reported knowledge of artificial intelligence and comfort levels with artificial intelligence and its implications on personal health data used in healthcare.

Data points were not included in the analyses if a respondent answered "Don't know" for Q2, Q3 and Q4 where "Don't know" was an option.

2.5. Statistical analysis

2.5.1. Design

This study employed ordinal logistic regression models to investigate the associations between dependent and independent variables, including age, income, education level, and gender. The dependent variables were transformed and ranked on an ordinal scale from lowest (1) to highest (4), reflecting the different response options. Multivariate polynomial regression was performed to gain deeper insights into the underlying relationships, considering both linearity and quadratic effects and exploring potential interactions between different variables influencing responses.

2.5.2. Data transformation

Options for each dependent variable were systematically transformed into ordinal categories, and the independent variables (age, income, education level, and gender) were encoded as factors. This transformation allowed for the application of ordinal logistic regression models, capturing the ordered nature of the dependent variable responses.

2.5.3. Heterogeneity of study sample sizes

The sample sizes of the specific age, income, and education categories across the three genders used in this study were heterogeneous. While transgender and non-binary Canadians account for only 0.33 % of the overall population, it was relevant to include this group in our study to understand their attitudes towards AI.[21] The survey provided data from respondents who identified as "Other" which had a lower sample size compared to the "Male" and "Female" study populations. On balance, it is easy to exclude this sample, but given the historical propensity to exclude marginalized populations from studies, we felt that it was important to retain this population despite the small sample sizes. The multivariate polynomial regression provides an acceptable analysis of heterogeneous population sizes without introducing significant bias due to variations in the sample size. Excluding this population in our opinion would introduce more bias.

2.5.4. Software and tools

Ordinal logistic regressions were conducted using RStudio Version 4.3.2. Ordinal logistic regression models were fitted to explore the relationships between the dependent and independent variables. The models aimed to assess the impact of age, income, education level, and gender on the ordered response categories.

Multivariate polynomial regression was conducted using the Design of Experiments (DOE) Pro (obtained from SigmaZone) software add-on within Microsoft Excel. The multivariate polynomial regression allowed a more nuanced exploration of the complex interactions and non-linear associations between variables.

These analytical approaches provide a comprehensive understanding of the relationships between the variables under investigation, offering insights into both linear and non-linear patterns and potential

interactions influencing the ordinal responses.

3. Results

3.1. Descriptive statistics

Descriptive data of the respondents' sociodemographic characteristics included in this study are shown in Table 1.

3.2. Key findings

Representative plots for the multivariate polynomial regression analyses are presented in Figs. 1–4. The findings from the ordinal logistic regression analyses are presented in Appendix Table 1.

Knowledge of AI Across Demographics: Knowledge of AI varied significantly across age and gender groups (Fig. 1). Women consistently reported lower levels of knowledge about AI compared to men and respondents in the "Other" gender category. Notably, individuals identifying as "Other" demonstrated the highest levels of self-reported AI knowledge, a trend that remained consistent across different income and educational levels. Younger respondents and those with higher levels of education generally showed greater familiarity with AI, suggesting that education and generational factors may play a role in fostering AI literacy. This pattern points to a potential knowledge gap that may need addressing, especially among women and older adults, to ensure equitable understanding of AI technologies.

Comfort with AI in Healthcare: Comfort with the use of AI in healthcare revealed non-linear associations with age and gender (Fig. 2). Middle-aged and older women reported the least comfort with AI, deviating from the pattern seen in younger respondents, who were generally more receptive. This non-linear relationship indicates that comfort with AI is not solely influenced by knowledge, as older individuals may still express discomfort despite their familiarity with AI. This suggests that additional factors, such as privacy concerns, perceived risks, and social influences, could impact how comfortable different age and gender groups feel about AI in healthcare settings.

Impact of Data Identifiability on Discomfort Levels: Respondents' comfort levels varied greatly depending on whether personal health data used in AI research was identifiable (with consent, Fig. 3) or de-identified (Fig. 4). High discomfort was associated with the use of identifiable data in research, indicating a general unease around the potential privacy risks of using identifiable health information. However, when data was anonymized or de-identified, respondents showed greater comfort, underscoring the importance of data privacy assurances in fostering public trust. Healthcare professionals reported greater discomfort with the use of AI compared to other highly educated Canadians, suggesting that professionals may have heightened concerns about the data security, bias, and overall reliability of AI technologies within the healthcare context.

Gender Differences in Comfort and Trust: Gender emerged as a significant factor influencing comfort and trust in AI. Women across all educational and income levels reported lower comfort with AI compared to men and "Other" respondents. This persistent gender gap suggests a broader need to address the unique concerns that women may have about AI, which could stem from broader societal patterns observed in technology and healthcare engagement. The lower comfort levels among women could also reflect underlying trust issues with AI technologies or discomfort with AI's potential to alter healthcare practices. Understanding these gendered differences is essential to ensuring that AI initiatives in healthcare are inclusively designed and communicated.

Interaction of Demographic Factors: The multivariate polynomial regression analysis revealed complex interactions between age, gender, and education that influence Canadians' knowledge and comfort with AI. For instance, while younger and more educated individuals were generally more knowledgeable about AI, comfort did not always follow the same pattern, as older age groups—particularly middle-aged women—expressed significant reservations. This complexity highlights that a single demographic factor cannot fully predict attitudes towards AI; instead, multiple sociodemographic factors interact in shaping these perceptions.

4. Discussion

While AI technology has garnered significant excitement in healthcare, our findings indicate varying levels of comfort across Canadian demographics. This study demonstrates that knowledge alone does not lead to comfort with AI, particularly among women, who report lower levels of comfort and trust compared to men and respondents identifying as "Other." This gender gap suggests a need for targeted efforts to engage women in AI education and outreach.

Our findings challenge the deficit model, implicit in the way data was collected for the dataset, which assumes that discomfort or skepticism towards technology can be resolved by simply increasing knowledge.[22] While familiarity with AI may reduce uncertainty, our analysis shows that knowledge alone is insufficient to foster comfort. Middle-aged Canadians, especially women, and healthcare professionals

Table 1
Descriptive statistics of respondents based on socioeconomic and demographic characteristics.

Factor	Age Category (Code)	Sample Size (Male - 1)	Sample Size (Female - 2)	Sample Size (Other - 3)
Age in years	16-24 (1)	274	549	28
	25-34 (2)	676	802	18
	35-54 (3)	870	815	19
	55-64 (4)	983	851	12
	65+ (5)	1841	1444	16
Income	< $24,999 (1)	321	455	26
	$25,000-$49,999 (2)	737	871	21
	$50,000-$79,999 (3)	1035	1044	18
	$80,000-$99,000 (4)	804	685	7
	$100,000-$149,999 (5)	1054	860	13
	$150,000-$249,999 (6)	556	457	5
	$250,000+ (7)	137	89	3
Education	Highschool (1)	827	975	37
	Apprenticeship/Trades (2)	323	185	2
	College/CEGEP (3)	1027	1195	17
	University degree (4)	1716	1578	23
	Masters (5)	597	432	11
	PhD (6)	105	66	0
	Medical/paramedical (7)	49	30	3

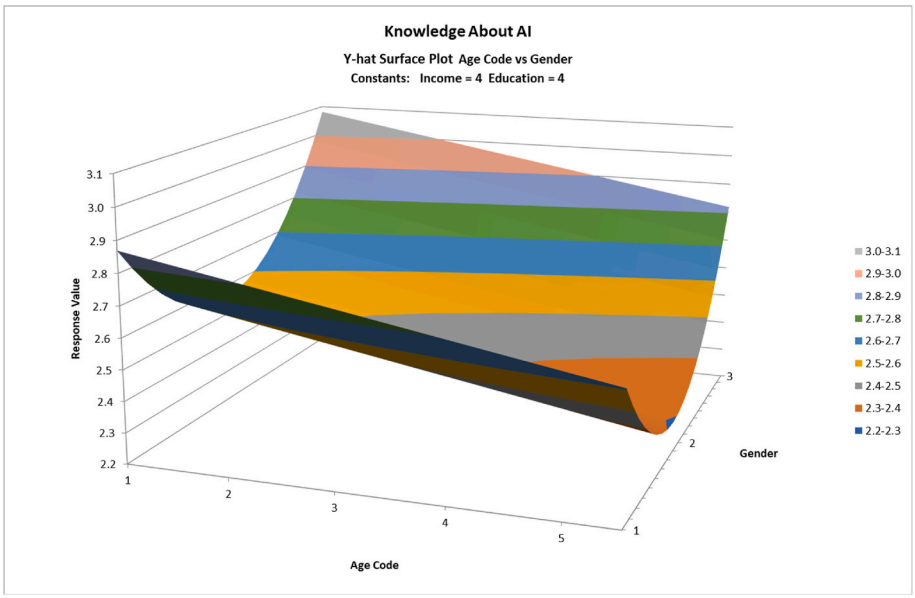

Fig. 1. Pareto chart of the ŷ values of the respondents' knowledge of AI against age and gender.
(Age Code) 1 = 16–24 years, 2 = 25–34 years, 3 = 35–54 years, 4 = 55–64 years, 5 = 65+ years. (Gender) 1 = Male, 2 = Female, 3 = Other.

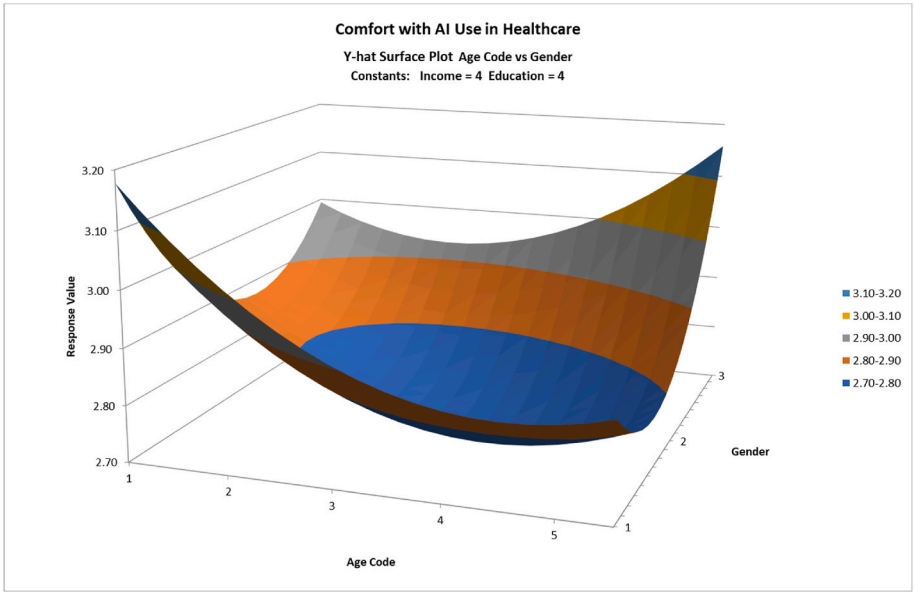

Fig. 2. Pareto chart of the ŷ values of the respondents' comfort with AI being used in healthcare against age and gender.
(Age Code) 1 = 16–24 years, 2 = 25–34 years, 3 = 35–54 years, 4 = 55–64 years, 5 = 65+. (Gender) 1 = Male, 2 = Female, 3 = Other.

remain uncomfortable with AI in healthcare, highlighting the importance of addressing factors beyond knowledge. Privacy concerns, trust in data governance, and the perceived maturity of the technology are significant influences on these groups.

The generational "trust gap" further illustrates the inadequacy of the deficit model. Older Canadians express greater concerns about AI's risks, indicating that knowledge needs to be paired with robust assurances about ethical data use and safety measures to foster acceptance. These findings align with data from a US survey, where a generational divide appears to exist with regards to the potential risk of AI.[23] The survey found that 'Boomers' were less comfortable with AI being used in the healthcare context compared to Gen Z, Millennials, and Gen X respondents.

Artificial intelligence will play an increasingly significant role in healthcare, revolutionizing diagnostics, patient monitoring, personalized treatments, and administrative processes. To implement AI successfully, public health practitioners and organizations must address public concerns through comprehensive strategies. Involving diverse patient groups in AI design and testing will ensure inclusivity, while ethical frameworks and fairness audits can help prevent embedded biases. User-friendly, transparent AI interfaces can empower both patients and providers to understand AI's role in healthcare decisions. Training for healthcare providers, coupled with robust regulatory oversight, could increase trust in AI's safety and effectiveness.

Establishing feedback channels for patients and adapting AI tools based on real-world experiences can further enhance comfort, as users see their input valued. Public awareness campaigns to improve AI literacy and dispel misconceptions also play a vital role. By combining inclusivity, transparency, education, and strong governance, healthcare organizations can build trust and acceptance, paving the way for

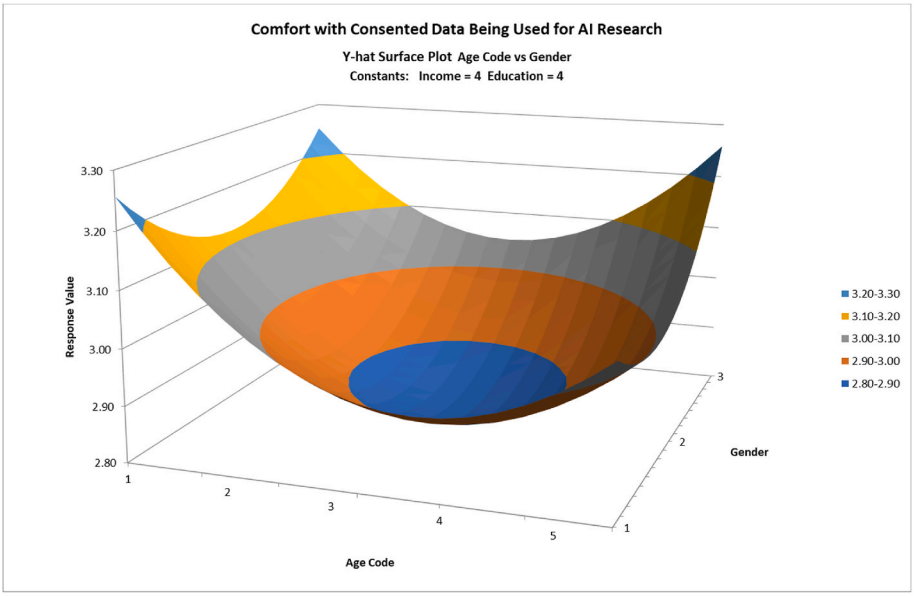

Fig. 3. Pareto chart of the ŷ values of the respondents' comfort with consented data being used for AI research against age and gender. (Age Code) 1 = 16–24 years, 2 = 25–34 years, 3 = 35–54 years, 4 = 55–64 years, 5 = 65+. (Gender) 1 = Male, 2 = Female, 3 = Other.

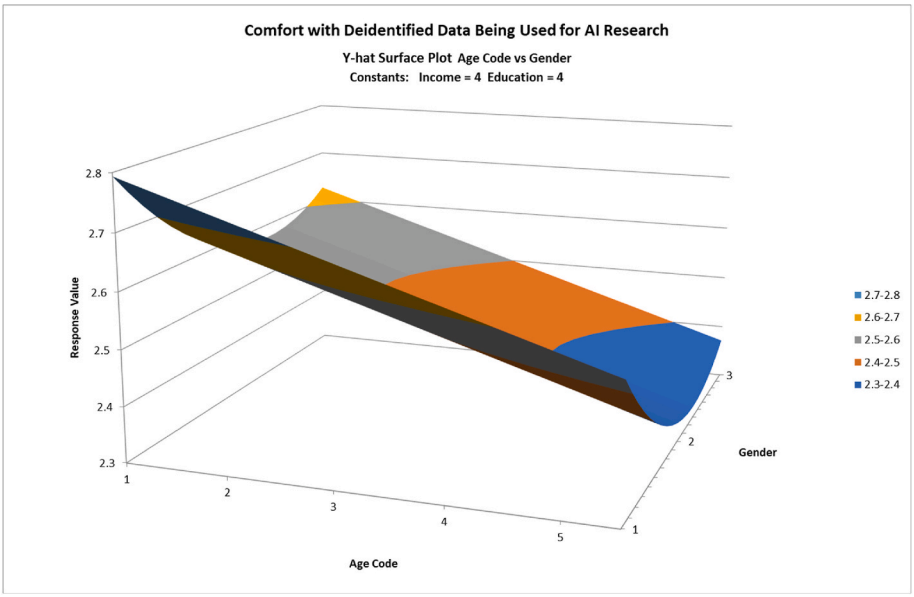

Fig. 4. Pareto chart of the ŷ values of the respondents' comfort with deidentified data being used for AI research against age and gender. (Age Code) 1 = 16–24 years, 2 = 25–34 years, 3 = 35–54 years, 4 = 55–64 years, 5 = 65+. (Gender) 1 = Male, 2 = Female, 3 = Other.

equitable and effective AI solutions.

4.1. Limitations

Limitations of our study include self-report bias since this study uses the data from the CDHS, a self-reported survey. The validity and reliability of the data cannot be determined due to the nature of the survey design. Given the general nature of the questions in the survey, the interpretation of the question depends on the respondent; different respondents may interpret the question very differently. However, given the large and varied sample, the results provide relevant insight into Canadians' attitudes toward the use of AI in healthcare and research.

Author statements

Ethics approval

Research ethics board approval was not required for this study since the data was made publicly-available by Canada Health Infoway.

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Competing Interests

The authors of this paper have no conflicts or competing interests to declare.

CRediT authorship contribution statement

Anson Kwok Choi Li: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – original draft, Writing – review & editing. **Ijaz A. Rauf:** Conceptualization, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **Karim Keshavjee:** Conceptualization, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing.

Generative AI disclosure

During the preparation of this work, the authors used ChatGPT 4o from OpenAI to harmonize the text. After using the tool, the authors reviewed, edited and re-inserted the relevant references as needed. The authors take full responsibility for the content of this publication.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.11.019.

References

1. Gupta R, Srivastava D, Sahu M, Tiwari S, Ambasta RK, Kumar P. Artificial intelligence to deep learning: machine intelligence approach for drug discovery. *Mol Divers*. 2021 Aug 12;25(3):1315–1360.
2. Carrillo-Perez F, Pecho OE, Morales JC, et al. Applications of artificial intelligence in dentistry: a comprehensive review. *J Esthetic Restor Dent*. 2022 Jan 29;34(1):259–280.
3. Cascella M, Montomoli J, Bellini V, Bignami E. Evaluating the feasibility of ChatGPT in healthcare: an analysis of multiple clinical and research scenarios. *J Med Syst*. 2023 Mar 4;47(1):33.
4. Hopkins AM, Logan JM, Kichenadasse G, Sorich MJ. Artificial intelligence chatbots will revolutionize how cancer patients access information: ChatGPT represents a paradigm-shift. *JNCI Cancer Spectr*. 2023 Mar 1;7(2).
5. Ruksakulpiwat S, Kumar A, Ajibade A. Using ChatGPT in medical research: current status and future directions. *J Multidiscip Healthc*. 2023 May;16:1513–1520.
6. Yu KH, Beam AL, Kohane IS. Artificial intelligence in healthcare. *Nat Biomed Eng*. 2018 Oct 10;2(10):719–731.
7. Bohr A, Memarzadeh K. The rise of artificial intelligence in healthcare applications. In: *Artificial Intelligence in Healthcare*. Elsevier; 2020:25–60.
8. Pou-Prom C, Murray J, Kuzulugil S, Mamdani M, Verma AA. From compute to care: lessons learned from deploying an early warning system into clinical practice. *Front Dig Health*. 2022;4.
9. Unity Health. *AI at Unity Health [Internet]*; 2024 Feb. Toronto https://unityhealth.to/about-unity-health/ai-at-unity-health/. Accessed April 9, 2024.
10. Canada Health Infoway. *Canadian Digital Health Survey 2021: Innovations & AI*; 2021 [Internet] www.infoway-inforoute.ca.
11. Cinalioglu K, Elbaz S, Sekhon K, Su CL, Rej S, Sekhon H. Exploring differential perceptions of artificial intelligence in health care among younger versus older Canadians: results from the 2021 Canadian digital health survey. *J Med Internet Res*. 2023 Apr 28;25, e38169.
12. Horowitz MC, Kahn L, Macdonald J, Schneider J. Adopting AI: how familiarity breeds both trust and contempt. *AI Soc*. 2024 Aug 12;39(4):1721–1735.
13. Trinidad MG, Platt J, Kardia SLR. The public's comfort with sharing health data with third-party commercial companies. *Humanit Soc Sci Commun*. 2020 Nov 11;7(1):149.
14. Sunny S, Patrick L, Rob L. Impact of cultural values on technology acceptance and technology readiness. *Int J Hospit Manag*. 2019 Jan;77:89–96.
15. Hooks D, Davis Z, Agrawal V, Li Z. Exploring factors influencing technology adoption rate at the macro level: a predictive model. *Technol Soc*. 2022 Feb;68, 101826.
16. Bak MAR, Ploem MC, Tan HL, Blom MT, Willems DL. Towards trust-based governance of health data research. *Med Health Care Philos*. 2023 Jun;26(2):185–200.
17. Kerasidou A, Kerasidou C. Data-driven research and healthcare: public trust, data governance and the NHS. *BMC Med Ethics*. 2023 Jul 14;24(1):51.
18. Platt J, Nong P, Smiddy R, et al. Public comfort with the use of ChatGPT and expectations for healthcare. *J Am Med Inf Assoc*. 2024 Sep 1;31(9):1976–1982.
19. Coventry L, Branley D. Cybersecurity in healthcare: a narrative review of trends, threats and ways forward. *Maturitas*. 2018 Jul;113:48–52.
20. Canada Health Infoway. *Infoway Insights: 2021 Canadian Digital Health Survey*; 2024 [Internet] https://insights.infoway-inforoute.ca/digital-health-survey. Accessed April 9, 2024.
21. Egale. Brief on Statistics Canada Sex and Gender Data-Census 2021 Key takeaways [Internet]. Available from: https://egale.ca/wp-content/uploads/2022/10/Brief-on-Statistics-Canada-Sex-and-Gender-Data%E2%80%93Census-2021.pdf.
22. Novaes CD, Ivani S. The inflated promise of science education. *Boston Review*. 2022 Sep 22.
23. MITRE. *MITRE-Harris Poll Survey on AI Trends*. 2023 Sep.