Patient Perspectives on AI-Powered Medical Robots in Breast and Prostate Cancer Care: A Qualitative Study

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Abstract

Background: Nearly 250,000 cancer cases are diagnosed annually in Canada, with breast and prostate cancer representing 25% and 22% of new cases, respectively. Access to cancer care is often fraught with barriers and delays due to limited healthcare resources. AI applications in diagnostic imaging have enabled detection of early cancerous lesions with greater accuracy and efficiency. However, patient acceptability of AI in cancer care remains under-explored.

Objective: The objective of this study was to understand breast and prostate cancer patients' feelings, perceptions, and acceptability regarding the inclusion of AI-powered medical robots for cancer screening, diagnosis, and early treatment (Aim 1) and identifies barriers and facilitators to implementation (Aim 2).

Methods: In this qualitative study, semi-structured interviews were conducted with 15 patients with breast or prostate cancer. Participants were recruited from the Odette Cancer Centre in Toronto over six months (between May and November 2022). Data were analyzed using a conventional content analysis.

Results: Three categories emerged; Individual beliefs, understanding, and attitudes; Integration of AI into care; and Health structure, systems, and processes. Responses highlighted openness to AI-assisted medical robot integration in their cancer care, but with hesitancy. When considering introducing AI into their care, participants described the importance of reduced wait-times, benefits to care, extensive research on safety and reliability, and maintaining patient-centred care. Importantly, patients indicated that with appropriate education, clear communication about the technology, and assurances that AI would not diminish human interaction or judgment, they may accept AI-assisted care due to its enhanced accuracy and efficiency. Barriers included concerns about the reliability of AI-powered systems, potential loss of human interaction, and inadequate mitigation strategies for technical failures. Participants underscored the need for the continued presence of healthcare professionals during AI-assisted procedures to ensure safety and support.

Conclusions: Patients demonstrated a willingness to accept AI-powered medical robots in cancer care if these technologies are positioned as complementary to human-provided services rather than replacements. As cancer care advances into an era further integrating AI-technology, implementation plans should focus on ensuring that the human element remains present through maintaining patient-care team interactions, patient-centred education, and transparent communication. Personalizing patient education can support patient-centred care. In addition, it is essential that patients are provided adequate and accessible educational resources and information to foster confidence in using AI medical robots in their cancer care. These findings provide actionable insights for integrating AI technology in oncology while safeguarding high-quality, patient-centered care.

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Keywords: Artificial intelligence, breast and prostate cancer, cancer care, patient perspectives, patient-centred care, qualitative research, acceptability

Introduction

In 2024, an estimated 247,100 new cancer cases are expected to be diagnosed in Canada. Breast and prostate cancers are expected to account for 40% of all new cancer cases.[1] For patients, receiving cancer care can be a prolonged and complicated process from screening to diagnosis and treatment.[2,3] Petrova et al. (2022) refer to three stages of cancer care: the patient interval (symptom presentation to seeking medical attention), the diagnostic interval (seeking medical attention to obtaining a diagnosis) and the treatment interval (diagnosis to treatment).[4] The diagnostic and treatment intervals usually include medical tests and multiple appointments with healthcare providers across several medical offices or hospitals[4]. Hastening and helping patients navigate their care pathways are important steps towards bridging gaps in the system, and have been shown to improve cancer screening rates, wait-times, and lead to improvements in quality of life and patient satisfaction with care.[5,6] The integration of artificial intelligence (AI) technologies could be a new way of mitigating these issues, but there is a lack of understanding about the acceptability to patients and how to best guide implementation using a person-centred approach.[7]

Cancer care, including breast and prostate cancers, requires a great deal of medical resources and attention from medical professionals. Typical care pathways for prostate cancer (screening to treatment) are estimated to take between 163 and 367 days.[3] For breast cancer, it can take 60 days from screening results to starting treatment.[2] The high mortality due to breast and prostate cancer in

Canada, where 15 women and 14 men are projected to die of breast and prostate cancer every day,[8,9] illuminate a need for efficient and timely screening and treatment processes. This could be made possible by introducing AI-assisted medical technology in their care.[10,11]

Before integrating new technology into care, patient navigation and issues related to follow-up in cancer care need to be considered carefully. In a systematic review, Reece et al. (2021) identified several key issues regarding delayed or failed follow-up for breast cancer screening in primary care settings: physician-patient miscommunication, automated alert systems creating an over-influx of information, reduced coordination of patient medical health records, and inconvenient clinic hours and lack of availability of primary care.[6] In a study by Urquhart et al. (2023), survivors of prostate cancer were interviewed about their experiences with follow-up and post-treatment cancer care.[12] Participants described various issues including lack of information, resources and psychosocial support, which left them feeling unprepared in their recovery process. These perceived issues in their care were related to lack of availability of physicians and not being able to see the same physician throughout their care due to a physician shortage within oncology.[12,13] Swift detection and treatment of cancer can lead to better treatment outcomes and prognosis by reducing the amount of time cancer is left untreated, and reducing stress and uncertainty for the patient. Early detection and diagnosis may also allow for more targeted and less invasive treatment regimens;[14,15] when cancer is detected too late, less invasive options may not be possible. Advanced stage breast and prostate cancers may require more invasive interventions including mastectomies and prostatectomies.[15,16]

Timely medical attention is critical for optimal patient care, but the current Canadian healthcare system does not have enough healthcare professionals (i.e., imaging specialists, specialized oncologists and surgeons) to meet the increasing patient demand[13] due to rising cancer rates.[13,17] As a result, many healthcare professionals specialized in oncology, such as radiologists and oncologists, are overworked, leading to higher rates of burnout and compassion fatigue.[13,17] The limited availability and overworking of healthcare professionals contribute to accessibility issues for patients, especially in rural and remote regions, where accessibility and availability of specialized health resources are often even more sparse.[18,19]

Recent advances in technology such as the use of AI in cancer screening, represent a potential mechanism for increasing efficiency in wait times in the cancer pathways and reducing the demand on healthcare providers, reducing gaps in follow-up, excessive wait-times and issues with accessibility within the healthcare system.[10,11] AI has been shown to be an effective tool for breast and prostate cancer diagnosis and in prostate cancer Gleason scoring. Successful AI applications in diagnostic imaging have enabled detection of early cancerous lesions with greater accuracy and efficiency, with trialed technology often outperforming experts.[20,21] A 2017 study showed automated deep learning algorithms identified nodal metastases in histopathological analysis of breast tissue more accurately than an expert pathologist panel.[22] AI deep learning algorithms have assessed mammograms with proficiency equal to expert radiologists, with 5.7% and 9.4% reduction in false positive and false negative rates, respectively.[23] In prostate cancer screening, deep learning algorithms have demonstrated the potential to automate Gleason scoring of histopathologic images of adenocarcinomas, achieving 75% agreement with expert pathologists, demonstrating great model performance.[24] Similar AI-powered applications have been used with diffusion-weighted MRI to delineate cancerous and noncancerous prostate tissue.[25] As AI becomes more sophisticated, new opportunities in both diagnostic imaging and treatments are emerging with potential to transcend the accuracy and time limitations of traditional methods. Specifically, with the advent of AI and robotics, telemedicine applications are feasible and have the potential to mobilize high quality healthcare, allowing interventions to be carried out by medical robots, without a highly trained specialist onsite.[24,25]

While AI-powered robotic systems have the potential to expedite procedures and improve patient care, success of these technologies is contingent on patient acceptance. The needs and preferences of patients should influence both the development and the process of implementation of such technology into the healthcare system. This requires a comprehensive understanding of the perceptions of patients towards the use of such technology in their care. A systematic review by Yin et al. (2021) evaluated 26 studies determining AI applications in non-cancer related clinical settings; only three evaluated patient acceptability; all three projects reported high acceptance of the AI interventions, but these AI applications were less invasive than those required for cancer care.[7] A greater understanding of what may be deemed acceptable is necessary before conducting large-scale research evaluating the use of AI in breast and prostate cancer screening and treatment.[7,26]

Present Study

Using a post-positivist approach,[27] the current study sought to elucidate patients' feelings and imagined acceptability and hesitations regarding the use of AI in cancer screening, diagnosis and treatment if they were given the opportunity to have it as part of their care. Given the high prevalence and mortality rates of breast and prostate cancer,[1,8,9] and the need for efficient and effective care, this study sought to obtain the perspectives in these specific patient populations for the potential use of AI-powered medical robots in their cancer care.

Methods

Study Design

Through semi-structured, open-ended interviews with patients with early-stage breast and prostate cancer, this qualitative study aimed to answer the research question: How do patients feel about the use of AI-powered medical robots for cancer screening, diagnosis, and early treatment? Study objectives were to 1) illuminate patient understandings and feelings regarding the inclusion of AI in their care; 2) identify barriers and facilitators of implementing AI-powered robotic systems into cancer screening from patients' perspectives. This project was approved by the Research Ethics Board at [REDACTED FOR BLIND REVIEW].

Participants

Participants were recruited from breast and prostate cancer clinics at the [REDACTED FOR BLIND REVIEW], between May 2022 and November 2022. Potential study participants were identified by their physicians and contacted by research staff to determine eligibility, interest, and provide verbal informed consent. Inclusion criteria were: 1) English speaking, 2) aged 18+, and 3) female patients deemed "high-risk" by their physician and in need of magnetic resonance imaging (MRI) as part of their screening process for breast cancer or diagnosed with breast cancer OR male patients with elevated prostate-specific antigen levels and considered "high-risk" for prostate cancer or diagnosed with prostate cancer. Interviews were conducted by research staff with consenting participants over telephone or video (using the Zoom application).

Data Collection

Demographic information including sex and gender, ethnic identity, socioeconomic status, and geographic data (rural or urban) was collected prior to the first interview. While participants did report gender, they were referred based on a biological basis (i.e., risk for or current diagnosis of

prostate or breast cancer). Participants were asked to participate in two semi-structured interview sessions, each approximately 1-hour in length. The interviews, conducted by a research assistant, focused on participant feelings regarding the inclusion of AI-assisted medical technologies in their care, factors affecting their perception of AI in healthcare, and what they would find helpful when being offered access to these technologies in their healthcare.

Data Analysis

Interview recordings were transcribed verbatim by two research assistants who co-analyzed 30% of transcriptions and then independently analyzed the remaining data using a conventional content analysis approach.[28] Disagreements in coding were addressed through consultation with a third reviewer. Once the three reviewers agreed on an initial codebook, the primary reviewers each coded half of the remaining interviews, consulting with one another and the third reviewer and iteratively updating the codebook as necessary. Final codes were organized into sub-categories, which were further grouped into overarching categories. The final coding tree was established by the three reviewers in consultation with a fourth reviewer and the site principal investigator. Including the perspectives of multiple analysts helped limit potential biases of any given researcher.

Data saturation[29] was preliminarily assessed by the interviewer who concurrently tracked broad themes, which informed changes to the interview guide throughout recruitment and data collection. Saturation was then formally assessed retrospectively, over the course of data analysis. Reviewers maintained a thorough audit trail outlining the identification and adaptation of new and existing codes. Reflexive memos were maintained to document thoughts on the saturation process. No new themes emerged after the tenth interview transcript and analysis confirmed that the final themes were comprehensive and well-supported, with no significant new insights emerging from the later interviews.

Results

Participant Demographics

In total, 15 participants (6 females and 9 males) were recruited, all of whom completed both interviews. Of the 14 participants who reported demographic data (Table 1), 80% were Caucasian. The mean age of participants was 67 years (range = 41–88 years). 80% of reporting participants (n = 12, 7 male and 5 female) lived in urban settings, 13% (n = 2, 1 male and 1 female) lived in rural settings. Of the 10 participants who reported their annual household income, 7 reported an annual household income over $60,000.

Table 1. Participant Demographics

Demographic category	**Male (n = 8)**		**Female (n = 6)**	
	N	%	*N*	%
Ethnic identity				
White/Caucasian	8	53.3	4	26.7
Asian	-	-	1	6.7
Middle Eastern	-	-	1	6.7
Age range				
40-49	-	-	1	6.7
50-59	-	-	2	13.3
60-69	4	26.7	1	6.7
70-79	3	20.0	2	13.3

80-89	1	6.7	-	-
Household income				
Below $20,000	-	-	1	6.7
$20,000-40,000	1	6.7	1	6.7
$40,000-60,000	-	-	-	-
$60,000-80,000	3	20.0	1	6.7
$80,000-100,000	-	-	-	-
$100,000+	3	20.0	-	-
Geographical location				
Rural setting	7	46.7	5	33.3
Urban setting	1	6.7	1	6.7

**Note:* one prostate cancer participant did not report any demographic information

Conventional Content Analysis (Aim 1)

The content analysis identified 28 codes, which were then organized into 6 sub-categories, and further grouped into 3 overarching categories to best understand participant feelings of integrating AI-assisted medical technologies into their cancer care (Figure 1). The three overarching categories that best answered research question one were: Individual Beliefs, Understanding, and Attitudes; Integration of AI into Care; and Healthcare Structure, Process, and Communication.

Figure 1. Final Coding Tree: Organization of Codes > Sub-categories > Categories

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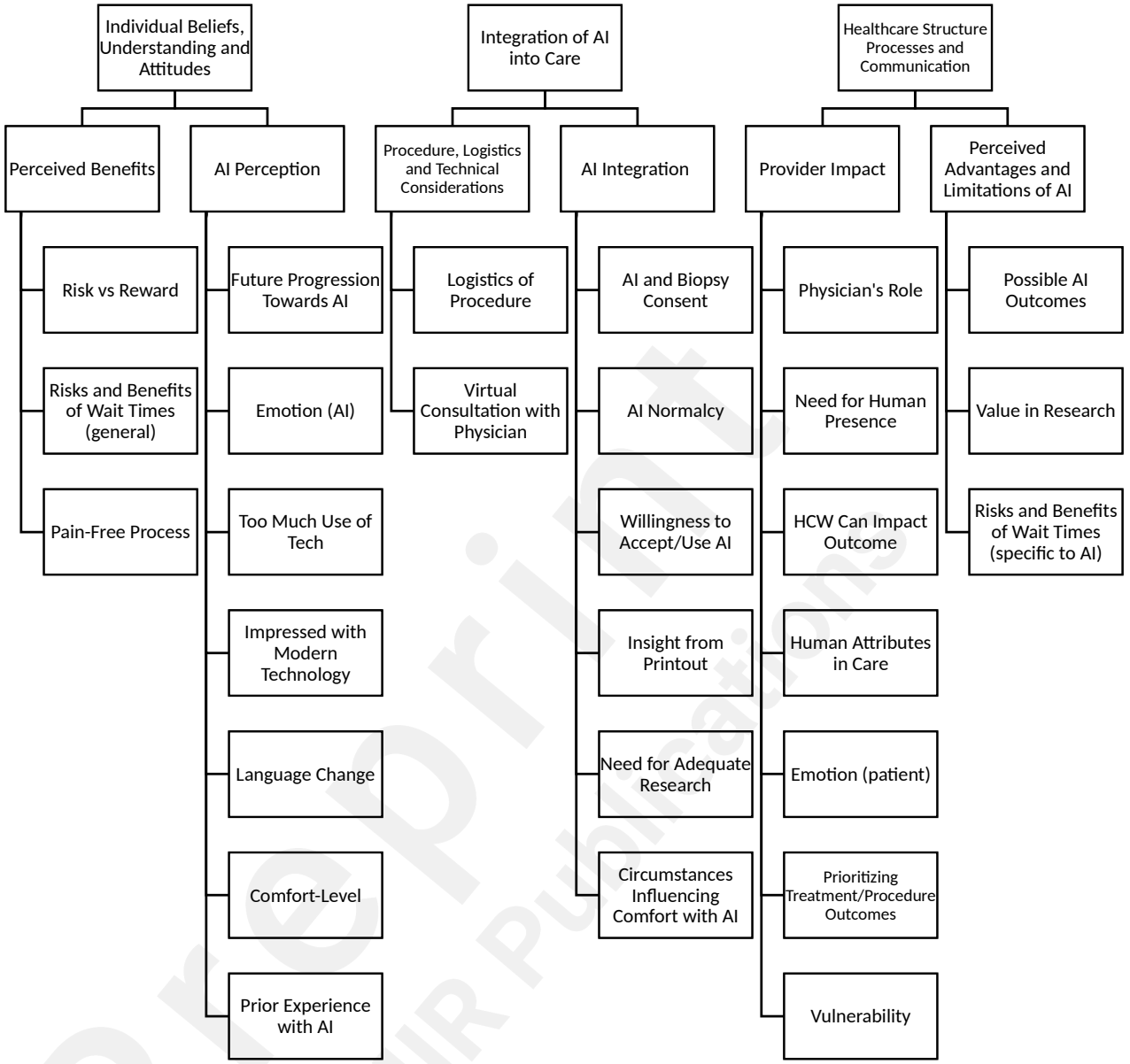

The *Individual Beliefs, Understanding and Attitudes* category included participants' comments on the use of AI technology in cancer care, discussing their beliefs about and perceptions towards the role of AI and feelings or factors that influence their willingness to use related technology. Overall, participants stated that they would be more inclined to accept the use of AI-assisted technology in their care if the benefits (e.g., making the process less painful or being more accurate) outweighed the risks.

While some participants negatively described a general over-reliance on technology, others noted that as these technologies become more standardized and once there is data to show that

"*they [are] as good as a human,*"

there will likely be more patient acceptability of and progression towards adopting them in healthcare. A notable concern regarding acceptability of AI-assisted technology focused on whether the technology can yet be considered dependable or safe, particularly in the context of healthcare settings. Participants also expressed needing to know that backup plans were in place in case of technical issues:

> *"…just certain things can happen, who would be available, in like an electrical shutdown and so on? Probably in an urban centre, it would work okay. If it was in a remote place, it would not be preferred… I don't know the capability of these machines, how reliable they are and so on [...] You know, I have been in an operating room where things have happened and you know they can happen. There's a small chance of it but nevertheless it's reassuring to have help nearby. It doesn't have to be right in the room, but nearby to jump in."*

Overall, participants shared that the more experience, understanding, and familiarity they had with AI-assisted technologies, the more comfortable they anticipated they would feel in the use of it in their cancer care. Participants expressed hesitancy about introducing AI-assisted medical technology into their current cancer care, but also expressed open-mindedness about AI-assisted technology having a role in healthcare in the near future.

The *Integration of AI into Care* category focused on the procedural, technical, and logistical considerations of integrating AI-robotic medical technology into cancer care, as well as general perceptions on AI integration into care. Upon receiving adequate information and assurance of the reliability of AI, there was a general willingness among participants to accept the use of AI-assisted technology in cancer care for less invasive procedures. Patients prioritized successful treatment outcomes over the specific provider of treatment (i.e., AI-assisted technology vs. human practitioner), indicating that the potential effectiveness of AI-assisted technology in improving health outcomes could enhance acceptance:

> *"I don't see any - I don't see any negatives. I mean, in our industry, you see people, see robots manufacturing items that the human individual could not. Some of their very fine minute connections they make and details [robots] do which is not, it's not done by humans[...] that's how life is, you know, when they're building cars or trucks or anything else that is highly technical, they use robots for some of the very technical work and as long as you're aware of that [...]I mean we have a friend who is a vein surgeon and he uses [...], I've never seen them but they look like long needles attached to his hands to fix fine veins and he can work on less than [...] an inch with accuracy and with consistency and with steadiness that he could not do if he didn't have AI. So, I'm impressed by that and I see also that AI works in many other areas, in other things that it does. So, to use the AI on the human body, providing that it's explained, go ahead."*

Some participants expressed comfort in having AI-assisted technology play a part in their care, but had reservations about the extent to which it could be involved:

> *"I think to do screening, I think I am okay with [the machine doing] that, if you could speed up the waiting, the wait time… For the actual surgery I think I need more evidence, proven evidence, that it is 100% positive and reliable."*

Participants highlighted the need for targeted education regarding AI-assisted technology, within and beyond healthcare:

> *"I think, more education has to be, you know, done at every level, like in hospitals, news media, social media …About the AI efficiency and reliability because people are like me, I was very ignorant about this technology. So, if we can educate people through all kinds of communication channels, that will help people to gain the knowledge and confidence in the technology and then finally accept this."* Specifically, participants discussed the need for adequate education regarding how AI-powered technology would be used in their care (i.e., how it works, benefits, and limitations) and the reliability and safety of the technology, including thorough information regarding testing and technical regulations.

Participants explained that having this information before meeting with their physician would support the decision-making process.

> *"Prior to the treatment and all, a webinar would be helpful. So, for when – when they told me: 'we need to remove your breasts,' before I saw the plastic surgeon, I went to a webinar. It was in-person and they gave me all the information that I needed prior to seeing the doctor. So, I had a good amount of background information so when I saw her, I made the decision on which procedure I prefer to go with, and it was very, very helpful. So, yes prior to using this technology - like an information session, let's call it - it could be very, very helpful. Give you all the background information and then you would see the doctor."*

Participants discussed multiple modes of delivering information (e.g., webinars or information sessions), and highlighted the importance of bringing information to patients proactively, so that they did not need to search it out on their own:

> *"I had to take the initiative to search through the website to get [information] and knowing so many people, they are not familiar with using technology, or some seniors, I think that was, you know, it limited the opportunity for people to get [access to] support resources."*

Though patient education was not described as a responsibility solely of the healthcare team, participants highlighted the vital role of healthcare providers in mediating the introduction and integration of AI into care. Many discussed the "*emotional aspect"* of care, explaining the importance of making patients

> "*feel comfortable. You gotta make that person, give that person – I think the word is hope, is the word."*

Participants believed that physicians and technicians should be present in varying capacities during any procedure. Some patients preferred to have the physician or technician in the room during the procedure(s), in case "*something went wrong."* Participants explained that *"knowing that they were there and that there was some sort of like troubleshooting capacity, that would be helpful. Like having them there is one thing but if they don't think about the robot and it like malfunctions and starts like taking a biopsy in the wrong place then I would want to know that they were like trained in a way that would prevent any negative impacts if something went wrong."* Not all participants shared this concern; others were okay with having healthcare providers available virtually so long as a human was somehow actively involved in the process.

Participants also emphasized the importance and value of human presence in care (particularly that physicians should remain central in a patient's care in care processes), underscoring the importance of emotional support and other traits that are unique to humans.

The category titled *Healthcare Structure, Processes, and Communication* focused on issues related to the healthcare system and how these impact patient care experiences and patients' willingness to use AI-assisted medical technology, as well as their perceived advantages and limitations of AI in this context. A recurring theme in participant responses was the perception that the current healthcare system often lacks personalization, leading to patients feeling "*lost in the system."* Participants reported that this lack of personalization in care is exacerbated by systemic issues that cause long wait times, not having enough time to communicate and clarify all questions with healthcare staff, and delays in diagnosis and treatment. Participants highlighted the value of being able to

> *"get results immediately rather than having to wait three weeks."*

One participant emphasized the distress and difficulty they faced related to the lack of timely care:

> *"I had a cystoscopy [...] It was too tight to catheterize so I couldn't get any surgery done immediately. [...] several weeks later, I finally got a turp done. So, that's several weeks' wait [...]. It was very difficult. And I couldn't get care in a timely way."*

These participant reports highlighted the critical need for improvements in healthcare processes and efficiency. Participants shared that systemic delays not only cause physical discomfort but also contribute to a sense of being neglected. Additionally, participants expressed that this feeling of neglect can contribute to patients being hesitant to trust new technologies, such as AI-assisted medical robots, unless they are assured that these innovations will address, rather than exacerbate, existing problems.

Barriers and Facilitators (Aim 2)

In the interviews, participants discussed factors that would increase their likelihood of accepting the use of AI-assisted technology in their care (i.e., facilitators) and factors that would decrease their likelihood of accepting such technology in their care (i.e., barriers). Table 2 provides an overview of the facilitators and barriers to integrating AI-assisted medical robots into cancer screening, diagnosis, and treatment.

Key barriers identified were concerns surrounding the machine technology lacking human characteristics such as compassion, as well as the reliability and safety of the AI robots, and the ability to manage unforeseen complications in the absence of a physician and ability to maintain communication with the patients. A participant highlighted this concern in a scenario where

> "*if something went wrong, knowing that [the attending physician] were there and that there was some sort of like troubleshooting capacity, that would be helpful. Like having them there is one thing but if they don't think about the robot and it like malfunctions and starts like taking a biopsy in the wrong place then I would want to know that they were trained in a way that would prevent any negative impacts if something went wrong."*

The ability of AI to streamline processes and deliver faster results was highly valued. The most prominent facilitator and a significant concern for many patients was the need for reduced wait times. One participant emphasized that

> *"if it's explained, the fact [that] they're going to get results immediately rather than having to wait three weeks - I think it's three or four weeks I waited when I had my prostate biopsy done. I would definitely do it, it's definitely a bonus, definitely a benefit. So yes, I would say yes, I would say yes to it, yes."*

Findings indicate that when given the choice, patients expressed enthusiasm for this innovation and may opt to use this technology despite some skepticism, because of the benefits of reduced wait times (e.g., fewer complications, overall better quality of care). Furthermore, patients prioritized successful treatment outcomes over their concerns of who or what delivered treatment, suggesting that the potential efficacy of AI-assisted technology improving health outcomes may enhance acceptance.

Table 2. Factors Influencing Patient's Decision to Accept AI in Cancer Care (Barriers and Facilitators)

Factor	Barrier	Facilitator
Information	Lack of information regarding the technology left patients unable to	Providing adequate patient education and related resources would facilitate

	answer whether they were comfortable using it.	the uptake of AI-assisted technology.
Vulnerability	These patient populations are particularly in need of human care due to the vulnerable nature of the procedures.	
Reliability of technology	Fear of technical malfunctions or similar issues.	Potential for increased precision and efficiency with the use of technology; some patients noted that the most important thing is a positive outcome, regardless of whether a doctor or robotic device is completing the procedure.
Human element	Machine lacking in compassion/bedside manner in critical thinking/problem solving skills.	No risk of human error when using AI-technology.
Reduced wait times		The potential for reduced time between initial appointment and treatment can improve patient outcomes and eliminate distress associated with waiting periods.
Prior use of AI-assisted technology in healthcare		Patients express prior knowledge or direct experience with some form of AI technology in healthcare, creating a greater sense of comfort with using AI.
Pain		Some participants stated that they would be more inclined to consent to the procedures if it was less painful than the standard of care.
Options available	Patients might prefer standard of care when they have the option (given that the risks/rewards are similar between these options).	If there were no other options, or standard of care came with increased risk (due to waiting times, etc.), patients would be more likely to consent to use of AI-assisted technology.

Discussion

This exploratory qualitative study sought to elucidate patients' feelings, understandings, and perceptions about the use of AI-powered medical robots in cancer screening, diagnosis, and early treatment, and to identify barriers and facilitators to patient acceptance. Participant responses illustrated some hesitancy around embracing this technology for their own care, which is a typical response towards technological advances or change,[30,31] as well as positivity and hope about the possibility of upcoming expedited healthcare processes. Participants expressed a cautious openness towards the use of AI in their care, often noting that they would likely consent to its use if the benefits, such as increased accuracy, reduced pain, and reduced wait times, outweighed the risks.

Many participants stated that having available data regarding the effectiveness of technology would be important for them in order to agree to its use in their care, posing a potential challenge to the feasibility of conducting this research to gather said data in the first place. Nonetheless, facilitators to using AI-assisted medical robots in cancer care (e.g., the potential for AI-assisted technology to mitigate health process-based concerns by reducing wait times and streamlining the diagnostic process) may be sufficient motivation for patients to participate in research. Concerns related to long wait times have been a longstanding issue for patients in cancer care pathways,[6,10,11] and participant responses suggest an understanding that health-related technological advances likely represent a solution to this issue. Moreover, it may be effective to run trials of AI-assisted technology in cancer care in regions where these concerns may be exacerbated or over-represented, and where there is limited access to specialists and/or particularly long wait times (i.e., rural regions). Incorporating AI-assisted technology in cancer care within these regions might provide patients with the potential benefit of earlier treatment and reduced need for traveling far distances for care, which might outweigh the perceived potential risks of participating in early trials.

One barrier reported by participants was hesitancy around removing the human element from their care, this is also in line with previous research.[32] Findings from interviews highlighted the importance of communication, compassion, and support regarding their care, suggesting a high value towards patient-centred care.[33,34,35] Participants assumed that the use of medical robots in their care would limit or remove the relationship that they have with their physicians. Though this technology removes the need for clinicians in certain care stages (i.e., the diagnostic interval), AI-assisted medical robots would not entirely replace physicians. In addition to the skills and expertise required for other parts of the care process, these robots cannot replace the compassion and communication skills inherent to humans.[32] Having such technology to perform more routine tasks could instead free up more time for physicians to engage meaningfully with their patients. Still, there may be fewer points of contact between patients and physicians. As such, those developing plans to implement such technology should consider ways to foster relationship-building more efficiently during visits, and through offering various modalities (ie., virtually, over the phone).

It is important to be conscientious about how adding new technology such as AI-assisted medical robots into healthcare might work in practice, and the role of healthcare providers in implementation and patient communication. Patients should be able to receive information on these technologies from various accessible sources as having healthcare providers be the only informants of the new technology for patients may contribute to frustration with technology.[36,37] Participant suggestions regarding educational resources to improve their comfort levels and facilitate acceptability with this technology included the use of pamphlets, brochures, webinars and workshops, AI literacy programs, reliable research articles, and reports about AI in popular media. This focus on different types of patient health education for new technology may alleviate potential additional burden on overworked healthcare practitioners.[12,13] Moreover, these additional sources of health education may help to make time spent with physicians more meaningful and used for further clarification on the use of the technology and additional expectations of procedures and timelines. This might help to provide physicians with adequate time to develop patient-physician trust and compassion to further foster patient comfort and build a sense of efficacy; an aspect of care that our participants so notably prized. The overall goal of integrating this AI technology should be to aid, supplement, or work in adjunct with the physicians and not to add to their workloads. By adopting this method of patient health education, there may be a wider spread of information and increased accessibility for patients in more rural or underserved settings, and more streamlined cancer care pathways.

Overall, while participants expressed openness towards the use of AI-assisted technology in care, targeted efforts are required to implement it in a way that will be acceptable to patients. Patients will

need reassurance of the effectiveness and safety of the device from comprehensive research, clear communication and information so that they can make informed decisions about their care.

Limitations and Future Directions

There are several limitations to this study, which was designed to explore patient perspectives on the integration of AI-assisted medical robots into cancer care. Recruitment occurred at an urban hospital and is likely to not be representative of all individuals. This is related to a previously established limitation regarding the disparity in who has access to high quality healthcare.[38] Participants were recruited from a large regional cancer centre in Toronto, and therefore may under-represent those in rural settings who did not access this tertiary care. Participants primarily reported living in urban settings and having higher-income households. Urban and higher-income populations may have more exposure to and comfort with advanced technologies compared to their rural and lower-income counterparts.[39] Additionally, the perspectives of those who live in rural settings may be impacted by experiences with resource limitations and accessibility of healthcare.[40,41] Furthermore, the majority of the participants (80%) identified themselves to be ethnically Caucasian, thus, intersectional representation is a limitation for this study, as we were not able to attain a representative group of participants. Future work should seek to gather perspectives of those without access to tertiary care or those in rural regions, and ensure that the study sample is representative of sexual, gender, and ethnic identities to increase transferability of findings.

As data collection occurred during the COVID-19 pandemic, attitudes towards access to healthcare or experiences with healthcare delays may have been impacted by the healthcare climate at the time.[42,43] Finally, these interviews reflected the patient perspective, and it is important that future studies seek to understand the perspectives of AI-integration in cancer care from healthcare providers and caregivers/family members, in order to best guide the implementation of such technology.

Future research should ensure to gain perspectives from patients that represent a more diverse lens as a means of increasing transferability of findings and understanding specific needs for integrating AI-assisted medical technology into cancer care in varying regions. It should also aim to include perspectives from all involved in the healthcare process (such as physicians and oncology assistants) to better understand how to pragmatically incorporate AI-assisted medical robots into cancer care screening, diagnosis, and treatment. More work is needed to best understand what type of implementation model works best for both physicians and patients, including how to provide education on the technology to both, what level of human presence is deemed acceptable and appropriate, and safe mitigation strategies in the event of technical issues.

Conclusions

In conclusion, this study explored patient perspectives on the use of AI-assisted medical robots in cancer screening, diagnosis, and early treatment, highlighting barriers and facilitators to its' acceptance. Findings from this study provide a nuanced understanding of patients' perceptions and attitudes towards the integration of AI-assisted medical technologies in cancer care, paving the way for future studies by highlighting considerations for maintaining high quality experiences of care. The findings reveal a cautious optimism among patients, tempered by significant concerns about the reliability of AI, and the potential for reduced human contact. Patients expressed a desire for AI to complement, rather than replace, human judgment, ensuring that final decisions remain in the hands of experienced healthcare professionals. Alongside emphasizing the need for human presence and emotional support within the healthcare experience, patients described a need for education and clear communication regarding the use of new technology and suggested potential methods of making these resources more accessible (e.g., through popular media and information sessions).

Implementation plans should highlight points of contact between patients and their care team, along with accessible patient health education and maintaining the human aspect of care. Given these provisions, it is anticipated that patients will accept AI-technology in their care due to the improved accuracy and efficiency that AI will bring to their care. Successful implementation of this technology may aid in ongoing challenges with availability of oncology physicians and stress and burnout within the practice and facilitate more time for practitioners to spend with patients during fewer appointments, possibly allowing for more meaningful communication and contributing to increased satisfaction with quality of care.

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Conflicts of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Abbreviations

AI: Artificial Intelligence
MRI: Magnetic Resonance Imaging

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Appendix

Appendix A. Codes and Definitions

Code	Definition	Participant Quotes
Need/preference for reduced wait times	Patient emphasizes that cancer care must prioritize being quick and efficient	"I: Okay and if it was possible to begin treatment right after diagnosis, so while you're still there begin treatment already, by that same medical robot, would you want that? Or would you want to wait? That would be too quick fast. P: As fast as possible I guess is okay [...], that's the main thing, you know, that's a – if you have to wait and wait and wait and then that's not good either."
Risks and benefits of wait times (general)	Patients share thoughts and experiences related to delays in their care experience	"The important things we need is faster, accurate diagnoses and availability is crucial and even if people are super affable it's no good if you can't get care."
Risks and benefits of wait times (specific to	AI influence on treatment wait times	"You got to say that, you know, we have a fantastic new process which will reduce your waiting time, reduce your visits and it's well

AI)		proven and we were very impressed by it.”
Systemic issues	Need for systemic change	“I think I see a lot of people get lost in the shuffle in our medical system, they can't - they can't make contact with those doctors or they just get lost and they – we need to improve things.”
Comfort-level	How comfortable patients are with AI and receiving cancer care from AI	“I: So, do you have any concerns about the use of artificial intelligence and cancer care? Are there anything - is there anything that worries you about it? P: No that doesn't bother me, as long as I am looking – as long as I am looked after, you know.”
Future progression towards AI	Sentiments of how ultimately society is moving toward more tech/AI	“I think it's very, I would say, inevitable direction for this type of medical diagnostic to go, because I think AI is definitely ultimately going to be in charge of these types of sort of reading of data from instruments like MRI's, I mean it's just the machines are better at it. That’s just – that’s just the way it is.”
AI and biopsy consent	Thoughts and feelings related to AI doing biopsies	“I: And would you be comfortable consenting to a biopsy prior to the MRI's so that the biopsy can proceed right away if there was a suspicious lesion detected? Does that bother you? P: Doesn't bother me, no. I: No? Okay and how would you want to be informed that there was a suspicious lesion and that the biopsy was going to happen? Could have the machine tell you or would it need to be a human? P: Has to be a human.”
Physician's role	Patient expresses importance/need for physician	“Let's talk when you know the doctor gives you the diagnostic. The approach of human being when they're saying that I'm not quite sure if a robot can do that but obviously, when they do the procedure, that is different.”
Emotion (AI)	Patient shares their thoughts on emotion in relation to AI (e.g., AI capacity to show emotion)	“I: Okay and can you detail specifically what it is about that that you are less comfortable with? P: I still think it, very simply, I still think that medicine has as much art in it as it has science and there is no art in a robot.”
Emotion (patient)	Patients share that their emotions/the emotional aspect of care needs to be maintained	“I: If you did go ahead with the biopsy and the AI assisted device was able to conduct the histopathology in order to make a diagnosis, how would you want to receive those results? So, would you want a future appointment with a physician – a physician? Immediately from a technician? Assuming that's legally allowed in the future, or a physician who was there virtually? Or

		would a printed readout from a machine suffice? P: Again, getting back to the emotional aspect. If the technician was capable and emotionally physically – emotionally capable also to pass on the information [about the diagnosis], it would, he would, - he could say ‘we found something, but it doesn't seem to be too serious; however, we will let you talk to a doctor.’ Rather than say ‘we found something, better see a doctor.’ Again, that's where the emotional aspect comes into it again. You gotta make that person feel comfortable.”
Human attributes in care	Patients share what attributes they deem to be important in care	“I: And how would you want to be - how would you be told that it's been tested, and it's been proven effective. So, is that with your own research? With the conversation with the doctor? If they gave you papers to read, what would that look like? P: Well, I think the main thing, one of the main things in the medical field is having kindness and compassion, which a computer can't do.”
Patient care experience	Perspectives, feelings, and preferences of patients regarding various aspects of their cancer care experience, and factors influencing their perspectives in using AI	“In my case there were a lot of decisions that I had to make and the doctor explained to me that, you could do this, or this, or this, and he recommended which one to do and I approved it. I said okay, let’s go with this.”
Need for human presence	There needs to be a person involved in the process to reassure, doesn’t necessarily need to be a doctor	“I: And your experience through all the different stages of the process how - how is that going for you? P: That has, well, I mean you know the process isn't had any true success yet but - but there's been lots of contact and lots of coaching and lots of human intervention in the process and that's appreciated.”
Need for fast and accurate diagnoses	Participant expresses that it's important to make sure that there are fast and accurate diagnoses given	“I: Okay and so you don't have any recommendations for how we can make patients more comfortable with this? How we can talk to them or anything - anything like that? P: Getting it as fast as possible. That’s the main thing.”

AI Normalcy	Patient speaks to the fact that since AI is a new technology in healthcare, it will take time for the public to get used it	“It's reassuring to have a physician on standby at least until things have been proven with more experience.”
Educational resources	Educational information and resources desired	“I: Okay and so what would you need to feel comfortable with the consent process of this if you were asked to participate? P: I guess any information that was already available or places to look for information even if it's not quite the same, but they could look up see what other uses the AI is using in medical, if there is, I'm sure there is. I: Would you need someone to like to walk you through it or, no? Even just like reading it, it’s better having access to resources. P: Um, maybe walk you through the consent but then having the resources available and if they need help, you know, finding those resources or actually looking it up with them -, to have that available if they wanted it.”
Circumstances influencing comfort with AI	Patient expresses situations and circumstances where they'd be comfortable or uncomfortable with AI	“I: How would you feel about the robot conducting interventional procedures such as a biopsy rather than an oncologist or radiologist? P: If [the procedure] was pretty straightforward, I would probably be comfortable. Like if [the procedure] was kind of in an awkward position be little bit more leery. I: So, it would depend on the circumstance? P: The circumstances, yeah.”
Desire for information	Information required about AI	“I: What would you need to know about the process of having AI involved in cancer screening and the process of diagnosis to decide whether you would be comfortable using this form of technology? P: Well, I think what I would want - I wanna know what the process is with the artificial intelligence as to exactly what's going to be done. I wanna know how it will be used, [...]um, as towards a - like for example is it gonna - like for example, when I had it, when I had my screening done, they were able to use the machines to locate and pinpoint with more accuracy. So, I'm thinking the same way with the article artificial intelligence, that it will do the same thing for anybody else who needs it.”

Need for adequate research	Need for established research in development and performance of AI	“If it's still really, really just in trials and I'd be, I think [I’d] have to think a lot harder about - about saying how much permission I would be happy to provide at that point. But, if it's, - if it's reasonably, you know, reasonably well proven at that point then I don't have a problem.”
Possible AI outcomes	Potential benefits and limitations of AI	“And there’s just some things machines could, – that they are very much better at than humans, so in some ways the machine has many great advantages.”
Training needed for staff with AI	Need for staff to have appropriate training for using AI	“And so, that – that would have to be brought up in training for them. [...]”
Standardized approach	Need for standardized practices, decision making, and processes when using AI in healthcare	“They would also need to let me know if the biopsy is being performed during the same session as the MRI and that there are standardized procedures in place to ensure accuracy. I would not want it to be a decision made by the AI itself.”

Supplementary Files

Figures

Final Coding Tree: Organization of Codes > Sub-categories > Categories.