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Article abstract

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ARTICLE (ÉVALUÉ PAR LES PAIRS / PEER-REVIEWED)

"The Death of Medicine as an Art of Humanity". Multi-Level Ethical Implications of Integrating Mortality Prediction Algorithms in End-of-Life Care

Jad Brake[a], Kelly Newton-Mari[b], Alice Virani[c,d], Anita Ho[e,f,g,h]

Résumé

Des algorithmes de prédiction de la mortalité (APM) basés sur l'intelligence artificielle ont été développés pour estimer l'espérance de vie d'un patient, dans l'espoir que les résultats fournis par ces algorithmes aident les professionnels de santé à déterminer le moment optimal pour entamer des discussions sur la fin de vie, afin d'améliorer la prise en charge conforme aux objectifs du patient. Cette étude qualitative, menée en Colombie-Britannique (C.-B.), au Canada, examine le point de vue des professionnels de santé sur les implications éthiques de l'utilisation des APM basés sur l'IA dans les soins de fin de vie. Cet article examine comment les APM soulèvent des questions éthiques familières mais aussi nouvelles, à plusieurs niveaux, concernant l'utilisation de l'analyse prédictive en médecine clinique. Ces préoccupations et considérations éthiques s'étendent sur quatre niveaux : individuel, professionnel, organisationnel et sociétal. Notre analyse de ces niveaux interconnectés révèle trois enseignements clés qui se recoupent : 1) la nécessité de redéfinir les rôles des cliniciens dans un paysage techno-thérapeutique en mutation; 2) le défi de gérer l'espoir en fin de vie dans le contexte de l'émergence d'outils prédictifs; et 3) l'importance de favoriser une approche équilibrée et holistique des soins de fin de vie face aux progrès rapides de l'intelligence artificielle. En mettant en lumière la complexité des implications éthiques de l'utilisation des APM dans le contexte sensible et vulnérable des dernières étapes de la vie d'une personne, ce travail fournit un cadre à plusieurs niveaux pouvant éclairer les meilleures pratiques. Il souligne également une vision globale des soins et insiste sur la nécessité de disposer de cadres éthiques, de lignes directrices, d'une collaboration interdisciplinaire et de formations pour guider la conception et la mise en œuvre des APM dans les soins de fin de vie.

Mots-clés

éthique, intelligence artificielle, algorithmes prédictifs, soins de fin de vie, mortalité

Abstract

Artificial intelligence-powered mortality predictive algorithms (MPAs) have been developed to predict a patient's life expectancy, with the hope that algorithmic outputs will help providers to find an optimal time to initiate end-of-life (EoL) conversations to enhance goal-concordant care. This qualitative research, conducted in British Columbia (BC), Canada, examines health care providers' perspectives on ethical implications of using AI-powered MPAs in EoL care. This paper discusses how MPAs raise familiar but also new multi-level ethical issues regarding the use of predictive analytics in clinical medicine. These ethical concerns and considerations span four levels: individual, professional, organizational, and societal. Our analysis of these interconnected levels reveals three key and overlapping insights: 1) the need to redefine clinicians' roles within a changing techno-therapeutic landscape; 2) the challenge of navigating EoL hope in the context of emerging predictive tools; and 3) the importance of fostering a balanced and holistic approach to EoL care amid rapid advances in AI. By uncovering the complexity of ethical implications of using MPAs in the sensitive and vulnerable context of the final stages of a person's life, this work provides a multi-level framework that can inform best practices. It also underscores a holistic view of care and stresses the need for ethical frameworks, guidelines, interdisciplinary collaboration and education to inform the design and implementation of MPAs in EoL care.

Keywords

ethics, artificial intelligence, predictive algorithms, end-of-life care, mortality

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INTRODUCTION

The World Health Organization (WHO) estimates that 56.8 million people require palliative care each year (1), emphasizing that palliative and end-of-life services are essential elements of healthcare systems (2). As computational capability, data sources, and machine and deep learning (DL) models continue to expand, there has been a growing interest in integrating artificial intelligence (AI) into health care (3). AI-based tools have been used in medicine for wide range of purposes, including mortality predictions, prognosis, diagnosis, disease detection, clinical decision-making (4), treatment, patient engagement, and

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administrative activities (3). Research has shown that AI-driven technologies have a potential to support the healthcare system by enhancing clinical efficiency and patient outcomes, improving the use of resources, and reducing workload burden (1,3).

For this paper, we focus on the implementation of mortality predictive algorithms (MPAs) developed using DL techniques. Several MPAs have been developed in various medical areas (5-12), including for end-of-life (EoL) care (13), with some of these tools showing to have a higher accuracy than that of experienced clinicians (10,13-15). Based on these promising results, enthusiasts hope that well-designed algorithms that incorporate a patient's clinical and broader context may assist healthcare professionals (HCPs) with making more accurate predictions of a patient's lifespan. This may in turn help HCPs better time their EoL conversations and promote goals-concordant care (13,16). By identifying those in-need of palliative services early, HCPs can better support patients and families in establishing proactive personal care plans and treatments (17). Proponents are optimistic that these technologies will enhance EoL care by better identifying the optimal therapeutic window for initiating goals of care conversations about patients' goals and wishes, thereby promoting autonomy and more personalized care while also decreasing costs and minimizing ineffective interventions (16).

Existing studies of HCPs' views regarding MPAs reveal that while clinicians mostly support integrating MPAs in medicine, they have ethical concerns regarding their use. Concerns include issues of bias and representation (18,19), data misuse and privacy (1,20), validity and implementation (21), AI ability to replace human skills of communication and empathy (22), diminished human connection between clinicians and patients (19) and the lack of transparency for "black-box" models (23). For example, Ahmad et al. (24) examined the views of palliative care professionals in England on the use of AI in palliative care. Participants viewed AI positively for identifying palliative care needs, but also expressed ethical concerns over data governance, confidentiality, and consent. Krishnamurthy et al. (25) examined multidisciplinary clinician perceptions on mortality prediction tools applied in cancer patients. Their study uncovered similar results, where clinicians described potential benefits of AI predictive models, including optimizing referral for early care and early conversations, better prognosis, and reducing distress and burnout. Concurrently, they raised concerns about accuracy, as well as uncertainties around patients' reactions to mortality predictions. Oncologists in Parikh et al.'s study (19) also highlighted improved prognostication as a potential utility of mortality risks algorithms for patients with cancer. Nonetheless, participants expressed doubts about algorithm accuracy and ethical concerns, such as over-reliance on AI predictions and automation biases, disclosure of an algorithm prediction, and losing the human connection in the patient-clinician relationship. Other studies discuss how even AI-driven tools that surpass humans in prognostic and diagnostic accuracy cannot replace the human element of care, including empathy and sensitivity to people's values and needs (13). Postill et al.'s study (19) with Canadian family medicine residents on AI-based survival estimation models in primary care revealed that care requires more than only mortality estimation, and that clinicians have lingering concerns around bias, privacy, and the lack of knowledge and confidence around these models and their use. Other studies cautioned similar concerns as potential barriers for successful integration of such technologies (20,21,26,27). Many researchers thus suggest a balanced approach between integrating AI and human aspects of care for successful implementation of AI-driven tools (1,28,29).

The relative novelty of clinical AI and the lack of clear evidence about the outcomes and consequences of its integration highlight the ethical complexities for using such tools in EoL care (28,30). Some researchers and institutions have proposed guidelines and strategies for ensuring ethical implementation of AI in sensitive health contexts including palliative care (28,31,32). Nonetheless, as Tyskbo and Nygren describe, AI mortality algorithms generate new epistemic, actionable, and ethical uncertainties (26), confirming an urgent need for ethical guidance, training, and education to ensure their ethical use in healthcare (1,22,33,34).

Despite the previously discussed studies, to the best of our knowledge there is no research specifically on Canadian HCPs' perspectives on the ethics of MPAs in EoL care. This qualitative study thus seeks to fill an important gap. Specifically, we explore HCPs' (physicians and nurse practitioners) views and attitudes on the ethical dimensions of implementing MPAs and the potential consequences for clinicians, patients and their families, health systems, and therapeutic relationships.

DATA AND METHODS

Study Design

This qualitative research was conducted in British Columbia (BC), Canada. The purpose of the study was to gain an in-depth understanding of HCPs' perspectives on the ethical dimensions and multi-level considerations of integrating AI-based MPAs into EoL care. Qualitative research offers the opportunity to interpret participants' perceptions and experiences (35). Accordingly, we employed semi-structured interviews, following a phenomenological approach, to enable in-depth analysis of individual interviews (36). Given the lack of empirical data and research specifically examining providers' perceptions of implementing AI algorithms in EoL care, this qualitative approach provides rich insights that can inform future studies (37). Before starting data collection, participants provided written consent and completed a demographic questionnaire. The study received ethics approval from The University of British Columbia Research Ethics Board (Application number H24-00711).

Sampling and Recruitment

Following a purposive sampling technique, the study included physicians (n=10) and nurse practitioners (n=5) with different demographic backgrounds (see Tables 1 and 2) and from different locations in BC, including Metro Vancouver (n=9), Fraser Valley (n=1), Vancouver Island (n=2), Northern BC (n=1), and the Southern Interior (n=2). Participants were selected based on the criterion of having active involvement in EoL care or were experienced in discussing prognosis and life expectancies with patients.[1] Further, to capture diverse experiences within the targeted research population, the study included participants from various of medical specialties, such as palliative care, oncology, emergency, pediatric care, geriatrics, cardiology, primary, internal, and family medicine. Recruitment used several strategies: distribution of flyers and information sheets about the study to local health institutions and authorities; and snowball sampling and mobilization of community health professionals to help identify and refer potential participants through word of mouth. Potential participants who expressed desire to participate were emailed a consent form and an invitation to participate in an online video interview.

Table 1: Characteristics of Participants

Characteristics	Participants N (%)
Total sample	15 (100.0%)
Age	--------
25-34	3 (20%)
35-44	5 (33.33%)
45-54	2 (13.33%)
55-64	5 (33.3%)
Gender (self-identify)	--------
Male	6 (40%)
Female	9 (60%)
Ethnicity or cultural background (self-identify)	--------
Caucasian/White	10 (66.67%)
Chinese Canadian	3 (20%)
Southeast Asian	1 (6.67%)
Mixed European Japanese	1 (6.67%)
Place of birth	--------
Canada	11 (73.33%)
Outside Canada	4 (26.67%)
Highest level of education	--------
Professional or Postgraduate Academic Degree (e.g. RN, MD, PhD)	10 (66.67%)
Master's degree or equivalent	5 (33.33%)
Years in profession	--------
1-5 years	3 (20%)
6-10 years	4 (26.67%)
More than 10 years	8 (53.33%)

Table 2: Participant Role: Physicians/Nurse Practitioner

Participant	Role
P1, P2, P4, P5, P6, P7, P8, P9, P11, P13	Physician
P3, P10, P12, P14, P15	Nurse Practitioner

Data Collection

Semi-structured interviews (n=15) were carried out between April 2024 and March 2025 by the first (JB) and third (AV) authors. All interviews were conducted online using Zoom, audio-recorded, and ranged from 31-52 minutes (average 41 minutes long). Interview questions focused on participants' perspectives on the effect that potential implementation of MPAs in EoL may have on the clinical practice, patients' experiences, and provider-patient relationships. The interview guide was developed following a literature review and the research team's knowledge and prior research experience. A mock interview was conducted, and the interview questions were modified accordingly to ensure clear wording and smooth flow between questions (see Appendix 1). Reflections and notes for observations (analytic memos) were taken right after each interview session. Data collection was continued until thematic saturation was achieved (no new themes emerged after interview number 13).

Data Analysis

All interviews were transcribed verbatim and anonymized by assigning a number to each participant. The first author transcribed (via Zoom) and checked all interviews for accuracy. This process constituted part of data familiarization, an initial,

[1] As nurse practitioners often provide a more advanced patient care and may have more experience in discussing prognosis and life expectancies with patients compared to nurses, they were selected to participate in the study.

but essential, stage of analysis that involves repeated reading of, and listening to, the collected data (35). After transcribing all interviews, the transcripts, memos, and demographic questionnaire results were imported into the NVivo 14 software, which we used to organize and code the data.

Given the lack of empirical data on HCPs' perceptions of implementing AI predictive algorithms in EoL care, we adopted an inductive thematic analysis approach that allowed us identify themes in the qualitative data and enabled an in-depth exploration of participants' accounts (35). We began inductive analysis with the initial data and constantly compared indicators, concepts, and categories as themes emerged. An initial cycle of coding was completed after the first (JB) and the last (AH) authors independently coded the first two interviews. Codes were compared, discussed, and modified to ensure intercoder reliability and coding accuracy and to arrive at a consensus codebook. Once the codebook was finalized and agreed upon by all team members, the JB independently completed the coding process for all remaining interviews. Guided by inductive reasoning, all codes were collapsed under themes and subthemes which were discussed and agreed upon by the team.

FINDINGS

The analysis revealed various ethical concerns and considerations across four levels: *individual*, *professional*, *organizational*, and *societal* (38). Within each level, several recurring themes and notable findings emerged. The findings also demonstrate interconnectedness of the multiple levels. This intersection offers a key perspective for understanding the complex interrelated layers of concerns and challenges related to the implementation of MPAs in EoL care as they are perceived by HCPs.

Table 3: Themes and Subthemes

Individual Level Considerations	**Themes**	**Subthemes**
	Personal sentiment and attitudes towards MPAs vary	• Optimism: MPAs as potentially beneficial • Caution and skepticism
	Implementation of AI prognostic tools	• AI as one tool among many • Need for evidence, knowledge, and experience
	Communication of AI prognostic information	• Prognostic conversations are complex • Preserving hope through communication
	Emotional readiness and consent	• Clinicians', patients' and families' readiness for the use of MPAs
Professional Level Considerations	***Themes***	***Subthemes***
	Potential professional benefits	• Enhance prognostication
	Professional concerns	• Shifting roles and responsibilities • Reduced professional judgment and clinical skills • AI replacing clinicians • Relational aspects of care: Reduced human element in therapeutic relationship • Team readiness
	Need for a balanced approach	• MPAs augment, do not replace clinicians' work
Organizational Level Considerations	***Themes***	***Subthemes***
	Potential organizational benefits	• Efficiency, cost savings, coordination
	Implementation: organizational constraints	• Lack of readiness, training, and oversight
	Changing work environment	• Workflow integration: overwhelming work, burnout and moral distress
	Potential conflicts	• Clinician autonomy vs organizational decisions
Social Level Considerations	***Themes***	***Subthemes***
	Implementation: social and systemic constraints	• Adaptation to rapid technological advancement • Limitations of existing healthcare systems and infrastructure
	Bias, inequity, misuse	• Representation, inequality, resource allocation • Misuse for cost-cutting or rationing
	Cultural implications	• Cultural, religious, and spiritual meaning around life and death • Cultural and religious conflicts • Culturally informed approach is needed

Individual Level Considerations

Participants conveyed a complex range of responses related to personally using AI-based tools, and particularly MPAs, in clinical care. For some participants, MPAs were perceived as beneficial tools with the potential to significantly advance their clinical practice and their patients' outcomes. Specifically, optimism about using this technology was often related to its perceived ability for analyzing large amounts of data and consequently improving prognostic accuracy:

> *I think that they [AI tools] can process a significant amount of data much faster and without bias. So, I do think that there is some benefit of processing a ton, more information, patient history, and presentations and diagnostics… as humans, I don't think we can necessarily do that kind of work.* (P12)

Considering their own practice, participants described improving prognostic accuracy as particularly valuable in EoL as it can help with them hold timely and informed conversations about goals of care:

> *Particularly in end-of-life care, I think it [MPAs] can be quite helpful to inform goals of care discussions, to inform prognosis, or to have support.* (P3)

In line with this concern, a common perspective that emerged from participant responses was that they would not fully rely on AI prognostic tools but may use them as "*another tool in the toolkit*" (P14). For example, one participant reflected that AI prognostic tools are "*never a replacement*" but instead "*a small piece of the pie that you now have one extra tool on your tool belt on how to predict what's gonna happen with this patient*" (P6). The same participant elaborated further, stating:

> *I would not completely rely on it, because I don't think I would fully trust an AI model to give me a clear prognosis, but it would just be one more piece of data that I integrate into my own clinical impression.* (P6)

Additionally, some participants stressed the idea that data generated by AI should be treated as just one part of the clinical data and information to look at, amongst the broader context of the patient's experience and clinical presentation:

> *We look at the patients, clinical factors, that various test results, and attempt to come up with an estimate of a prognosis…and I think AI would be one extra piece of information that would be added into that.* (P9)

One participant hoped for a balanced approach, one that combines the use of MPAs as additional clinical aids with human clinical practice and judgment, without the latter being diminished:

> *I would use it (MPAs) as a stimulus tool and then require my human clinical assessment and perspective on who the patient is, and who the family is, and things like that, in order to combine those two, actually inform my next steps, or, like, the actual care that I provide.* (P12)

Another common theme was the need for evidence and experience to support the use of AI-enabled prognostic tools in clinical care. Participants frequently emphasized that they would trust these tools more if they could see data confirming their effectiveness:

> *I think with any new intervention, I always, I am a little cautious until I see a little more evidence come out.* (P9)

Others expressed that they would like to test out the usefulness of these tools themselves in order to trust them:

> *I would need a period of testing it to see how accurate it really is in my own practice.* (P6)

In addition to questioning their own readiness to adopt AI-based tools, clinicians also reported concerns about patients' and families' readiness for the use of MPAs in their care or the effectiveness of specific models. They questioned both AI models' capability of predicting or assessing patient's readiness for palliative care as well as identifying patient's emotional preparedness to hear prognostic information:

> *I think that's probably where we would need some patient and family data to sort of evaluate these tools to see, did they want to hear that this is potentially a chance that they might die in like a few months? Did they want to hear that at that point in time? Are they ready to hear that? Those types of things.* (P3)

While many participants described prognostic accuracy as a major benefit and goal of MPAs, they raised questions around the value of predicting mortality, specifically patients' willingness to know their life expectancy. Based on personal experience, clinicians described this issue as being complex and proposed that the desire for hearing prognostic estimates is highly individualized:

> *I think they help certain kinds of patients who want to know more and who want to be advanced planners… but it doesn't help a lot of patients who don't think about their lives in this way and are just living day by day and aren't always planning for the future.* (P6)

In that regard, participants noted communication of AI prognostic information with patients and families as a major concern. For example, participants worried that the use of precise numerical predictions might be detrimental to some patients, possibly increasing emotional distress. Participants generally preferred using broad timeframes when communicating with patients to avoid causing harm:

> *If we ever have these tools, I don't think we should change the way we deliver … this information, which is right now in terms of ranges in time rather than specific numbers.* (P2)

In addition, numerous participants expressed concern that AI's ability to increase accuracy in predicting life expectancy could inadvertently lead to diminished patient hope or even loss of hope:

> *When things are uncertain people sometimes have more hope, and when there's more certainty, people may have less hope. So, I guess I worry about unintended consequences just because we can be more accurate doesn't mean the patient will feel better as a result.* (P5)

Others believed that realistic prognostic information could help patients find new forms of hope, if provided in the right way:

> *I don't think that AI would necessarily take away from people's hope, if its information given to people in a way that is allowing them to continue to have it.* (P14)

In fact, HCPs' testimonies reflected a non-dichotomous understanding of hope and illustrated the complexity of this issue in EoL care. The theme of reframing hope, as the last quote demonstrates, was central to many participants' reflections. Hope in the EoL care context was described as often shifting from cure and survival to comfort and control over one's remaining time:

> *I think that's where a lot of the barriers to involving palliative care come from, people feel like involving palliative care change, or will decrease somebody's hope or take away their hope. But I think one of the biggest things that I advocate for is reframing hope.* (P7)

In other words, rather than viewing hope as either present or absent, participants expressed a more dynamic understanding of hope as something that can coexist with prognostic awareness and be strengthened by constructive conversations. Knowing one's prognosis, for instance, was described as a way to support patients in planning and prioritizing meaningful experiences, and to redefine what they are hoping for:

> *It can change what that hope means for someone or what they're hoping for…for example, you had a younger patient recently who is given a poor prognosis, and she'd hope to kind of go here, there, and everywhere, and travel the rest of the year. And I think when, you know, she was given that information, it kind of helped her decide how she wanted to spend that remaining time.* (P3)

Other concerns were shared about when and how to use MPAs while ensuring patients' and clinicians' rights are respected and protected. In addition to emphasizing the importance of providing clinicians the flexibility and right to choose whether or when to use MPAs, which should be treated like any "*medical procedure that should not be enforced*" (P5) as one clinician described it, participants also suggested that whether to use an AI prognostic tool should be based on the particular patient's needs or desires:

> *I think choosing to not use it or use it is always going to be dependent on the person in front of you, because I can know all the things I know, and I can use all the tools I want. But if someone is adamant on something, then it doesn't really matter.* (P14)

Most participants viewed patient consent as an important ethical requirement in using AI prognostic tools. A few wondered whether a separate consent should be required for the use of AI predictive models, given that other predictive models (non-AI based) are already used by clinicians. Following this stance, some maintained that if MPAs are treated as "one more tool in the toolkit" (P14) then the consent should be about sharing predictive results with the patient and not the use of the model itself. Still, most participants claimed that an appropriate consent process is necessary for patients to be informed of potential benefits and more importantly, the potential risks associated with AI prognostic tools:

> *I think the patient has to have really informed consent about what are the impacts of this, the harmful impacts of this. Perhaps, you know, they would know what the potential benefits were, but what are the potential harms to having this information?* (P8)

Several HCPs related the need for proper consent to the vagueness and uncertainty surrounding AI prognostic tools and their outcomes, and the fact that they are not yet clinically proven:

> *… we should inform patients and perhaps have their consent, at least until that longer term data is available.* (P9)

Professional Level Considerations

At the intersection of individual-level considerations, participants articulated a combination of optimistic expectations and professional-level ethical concerns. Several acknowledged that prognostication is currently a weak spot in clinical practice, describing it as "*more of an art than a science*" (P7) and pointing to the difficulties of prognostication with current tools. This recognition resulted in participants' optimism about the potential contribution of AI prognostic tools to their professional work:

> *… prognostication is probably one of the things that we struggle with the most as clinicians, and where there's often not a clear gold standard…I can see why AI could particularly be useful in that regard.* (P9)

Another participant reflected on this issue in relation to mortality prediction specifically:

> *I think AI would probably be considerably more accurate, because I mean, current clinician judgment is notoriously inaccurate for production of mortality. People often live much longer or much shorter than what we would guess.* (P5)

Other participants explained the potential contribution of mortality prediction tools to EoL care:

> *Speaking specifically about end of life, predictive tools…would improve our working experience. Because it would be able to give us more accurate information that we can talk to patients with and help them make decisions with. I guess I'm optimistic in that sense.* (P4)

In addition, some participants mentioned that AI prognostic tools could enhance professional clinical care by facilitating more coordinated work among different care providers:

> *… it's very challenging for people [patients] to understand what their life is going to look like when they have experts in different areas only working on one thing [disease/medical condition] and not the whole overall picture... I think AI could take those kinds of things.* (P14)

Nonetheless, numerous participants raised concerns that clinicians may worry that using AI in prognostication will change the traditional boundaries and responsibilities of HCPs' roles:

> *Physicians are hesitant of change, because change is scary, and the status quo is easier, and I think artificial intelligence is a huge change in paradigm of how we approach clinical care.* (P1)

While clinicians described AI as a supportive tool, they also worried that MPAs might devalue professional judgment or lead to reduced clinical skills. As one participant explained:

> *What if we rely on AI and we lose our ability to be clinicians? We don't need doctors anymore. You can just [use] doctor Google, right?... And Dr. Google could probably, with all its little different AI machines, tell you when you need an X-ray when you don't need an X-ray, when you need blood work, when you need a urine test, right? Like you don't need to examine a patient anymore and I'm like, this is dangerous, medicine is going to die.* (P8)

Describing the integration of AI in healthcare as "*the death of medicine as an art of humanity*" (P8), another participant provided a common concern:

> *I have a real sense of this being a very bad thing for medicine generally... we lose our ability to be clinicians?* (P8)

Similarly, other participants also described the process of including AI tools in healthcare as "*taking out all human aspects of medicine*" (P6) and pointed to similar concerns about overreliance on AI tools:

> *My concern would be that if there were physicians who did that and who stop using their own brain and stop thinking and just relied on AI to give this number and to just, like, take that and just come to a patient and be like, the computer says you have a 50% chance of dying within the next 6 months…. That's a, just a future where we've really taken out all human aspects of medicine.* (P6)

Participants also emphasized the emerging responsibilities of clinicians as evaluators, and the crucial and necessary role of humans in critically analyzing AI-generated information, which the felt would always be necessary:

> *I think part of my worry, too, is if clinicians who don't have good foundational critical thinking of the whole scenario, rely on that (MPAs) to make their decisions. I think it should inform decisions, but it should not be making decisions… I mean, it's a human factor that will be the reality of using a technology like this that I don't know if there's an answer to it.* (P12)

Also, several participants pointed out the irreplicable role of the human element in therapeutic relationships, especially in EoL care, and described the challenge that AI may pose. Among some there was a consensus that the adoption of AI into clinical practice would negatively affect relational aspects of care, resulting from reducing humanness or even "*losing connection with human life*" (P8). Affirming the same stance, another participant explained:

> *Medicine is heading towards more of an algorithmic type of practice, and that takes away from the art of practice and the human, the humanness of humanity, of medical practice. And the more and more we head towards extremely data driven approaches, we're losing something in the process.* (P6)

Given the potential benefits that AI tools may bring, most participants expressed hope for a balanced approach, one that maintains the human element while integrating AI into clinical practice. AI-based predictive tools were seen as tools to augment and complement clinicians' abilities in decision-making, prognostication, and patient care, without replacing them or diminishing the human-to-human connection.

Furthermore, some participants questioned the readiness of clinicians and healthcare teams to adopt AI-enabled tools. Reflecting on this issue, they expressed uncertainty and confusion about how these tools would be implemented along with a lack of understanding about their design, a sentiment that was shared by nearly all participants in the study:

> *… one of the factors would really consider is how ready is the team? Is the team ready to sort of be trained to deliver this information in an appropriate way?* (P3)

Organizational Level Considerations

Several participants referenced the possible benefits that AI-powered prognostic tools could have at the organizational level. These include cost savings, resource planning and utilization, improved coordinated work and sharing of knowledge/clinical data among different care units and providers. The following quotes demonstrated some of these perceived advantages:

> *From an institutional level. I mean, you can kind of already see what the cost savings would be.* (P7)

> *I do think there might be some operational advantages. Because if you have a sense of which patients on your panel as a clinic, as a department, as a facility, as a multi facility program. If you have a sense of how many patients in a certain category you have, it might help you plan for care, because we know people in the last year of life, you know, resource utilization is particularly heavy.* (P11)

Yet, concerns about organizational adoption were also a prominent theme among participants. One recurring concern shared was the questionable readiness of healthcare systems to implement AI technologies due to the widespread lack of knowledge on MPAs among clinicians, including their design and use. Participants emphasized the need for organizational efforts to increase education, training and support:

> *All tools work better when there's adequate training on the tool. So, I think again, if clinicians are trained on how to use it... it's likely to be good.* (P5)

Another participant emphasized that education and training should be approached as a carefully planned "*change management exercise*" (P11) with a clear orientation process as well as ongoing evaluation after implementation:

> *Before you introduce such a thing, you really do need to orient all the teams involved. Here's what's coming, here's why we're doing it, here's what is an effective response… Make sure people have the training to deal with the information appropriately. And then monitor how it goes, right?* (P11)

One participant even suggested that patients may also need training before AI prognostic tools are integrated into their care:

> *If I were launching this in my institution, I would say, okay, here's the education modules the clinician has to do. And here's the education module that the patient has to do prior to implementing this, so that I know patients really understand what they're getting themselves into.* (P5)

Given the lack of knowledge and experience with MPAs and their unanticipated outcomes, the need for organizations to take their time when carefully integrating AI prognostic tools was presented as essential:

> *You can't rush it. You can't, just, you know, cut corners and just do it, right? And so that's always the worry I have with any new technologies, it'll just be rammed down our throats, and then it just will do more harm than good. But I think if you follow the right steps, orient the staff, have the teams ready, do education, and, you know, do proper QI and change management, it should be okay.* (P11)

Worries regarding the implementation of MPAs without adequate human oversight and supervision to ensure safe and effective implementation were shared:

> *I think if a hospital says, okay, now, we're going to use this AI model, I hope that there's humans behind evaluating it.* (P10)

Moreover, participants described the need for healthcare organizations to integrate AI prognostic tools into workflows in a strategic way that considers current realities and resource constraints. Several participants referenced "flag fatigue" (notifications) in EMRs, stressing the importance of acknowledging current practice conditions:

> *We may have so many flags. You know not just mortality, but for any number of reasons in healthcare, and already our EMRs are very busy with a lot of data and a lot of flags, and I worry about just being bombarded with this.* (P6)

Echoing such concern, some participants highlighted the stress AI prognostic tools could place on clinicians. They assumed that introducing these tools without providing necessary support could create an overwhelming work environment and contribute to clinicians' burnout and moral distress "*in a field that is already at a high risk of burnout*" as one clinician phrased it (P1). Another participant maintained:

> *So, it might be nice to have this data, but I struggle to see how we best actually incorporate it into practice, and I worry that it would just add to more stress and burden on us to have to address that. The AI said this about this patient, now you have to deal with it. Yeah, what you're gonna do with it?* (P6)

Discussing the potential harmful consequences for HCPs (stress, burnout etc.) of using MPAs in EoL care brought up concerns related to values of autonomy and conscientious objection in clinical work. One clinician argued:

> *… just because the institution provides it [MPAs], like, I don't think they [clinicians] should do it. Like, with all things in medicine, if you have a moral objection to something, I don't think you personally have to participate in that.* (P13)

Other participants also expressed repeatedly that "*AI should not be an automatic tool*" (P2) or that "*it should be up to the individual practitioner whether to use a tool or not*" (P6), endorsing the shared call among most participants to preserve clinicians' rights to determine when and how to use MPAs in their work. To reduce or deal with conflicts and disagreements that can arise between clinicians and their colleagues or between clinicians and their institutions, participants highlighted the need for a "*protocolized and institutional approach*" (P9) regarding the use and operation of these tools.

Societal Level Considerations

Some of the societal level concerns that emerged from the data, which intersect with organizational-, professional- and individual level considerations, were associated with current system constraints that do not allow the adoption of AI prognostic tools. This primarily focused on the mismatch between the high speed of AI advancement and the ability of the healthcare industry to adapt:

> *I think there's a bit of a disconnect with how quickly AI is moving and how historically slow the healthcare system is to incorporate new protocols, new approaches.* (P9)

Another participant also described the significant limitations of the existing healthcare systems and infrastructure that will pose a challenge for the implementation of advanced technologies and large data sets. The following statement illustrated this systematic constraint:

> *I think some of the barriers will be that, like my health authority doesn't even use a lot of our EMR. I still use paper chart. … it [EMR] would not be able to capture a lot of the data that might need to be fed into it, or that it'd be cumbersome to then have to or put in.* (P14)

Some emphasized that MPAs' potential ability to provide more accurate prognostic results is expected to not only help with clinical decision-making regarding treatments and interventions but also with resource allocation practices:

> *If we have a very active tool to predict prognosis, then I think it will probably then help us allocate patients more appropriately to where they should be and using our resources in that way more appropriately.* (P2)

However, multiple participants also noted the use of AI prognostic tools by institutions or systems to restrict access to care or justify resource-based decisions that do not always align with patients' best interests. Giving up suggesting or trying new treatments following MPAs' certainty about results was a major worry that some clinicians had around its consequences on public and individual's health:

> *Eventually you may get to the point where you say, okay, according to your AI predictor, you've got 3 months, so therefore we won't offer you this treatment.* (P5)

In relation to the same issue, another participant expressed the strong conviction that AI generally, and MPAs specifically, will guide how funds are allocated and wondered about the value of this possibility:

> *We know that hospital administrators and the fund holders will start to rely more on AI data and mortality predictions to fund services. And is that right?* (P8)

Discussions on treatments, resource allocation, and funding also speak to a broader ethical concern of misuse, or inappropriate use, of healthcare data and advanced technologies. This issue frequently emerged in participants' narratives through a range of examples as discussed at different levels throughout this article:

> *My concern is that it might be misused by the public, might be misused by those that don't have good moral ethics.* (P15)

Furthermore, while reflecting on the design and validity of AI predictive models, other societal concerns were mentioned. Among these are the potential of AI to reinforce discrimination and maintain social inequalities. This bias, which some viewed as inherent to AI-based tools, was not only ethically and morally troubling but also interpreted by some as a flaw that may reduce clinicians' and public trust in MPAs and their results. While one participant voiced that AI models are "more objective" in analyzing patient data compared to humans who "*all come with their own perspectives and biases*" (P12), more voices questioned the validity of the models, highlighting a broader worry about how algorithms can reinforce and perpetuate inherent biases:

> *If a model is generated to do something like predict mortality for a certain population in certain circumstances, then I think that would be very interesting to look at, if that is applicable to the population that I'm seeing, which is a big question. And if it's trained on data that is appropriate.* (P4)

Another participant expressed skepticism around model validity or generalizing results for different populations:

> *Yeah, number one would be patient selection, number 2 would be limitations to the program. I mean, you wanna know which patient population this has been tested on. And does this population that has been tested, is it similar to my population? And I guess I worry about broad adoption of a tool to populations that have not been specifically tested using the tool, like, if there's been no validation in, say, some rare tumor, then you shouldn't be using the tool for that.* (P5)

Moreover, it appears from the data that the general sense of ambiguity around MPAs and their design, and the doubt about even the possibility of knowing which data were used or selected, adds to what seems as conditional and cautious trust in MPAs. The following quote represented such sentiments among clinicians:

> *So, I'd want to know more about where the program came from and what population they used to put this data together. And I don't know if that's even available.* (P15)

On a global level, however, a few participants framed AI prognostic tools as a helpful way to acknowledge disparities between countries in relation to resourcing for EoL care:

> *From a global health perspective, I think it can be a powerful tool to get organizations to do better... maybe a kick in the pants about the inequities.* (P10)

Some participants raised concerns surrounding social and cultural implications of the integration or implementation of MPAs in healthcare. Specifically, participants' descriptions and testimonies regarding communication with patients highlighted how the use of MPAs intersects with cultural values, religious beliefs, and spiritual meaning. A few participants noted that their patients' religious belief may change the way they think about AI tools:

> *You're gonna have people that gonna say 'I don't want to hear what AI says.' It's in God's hands. And actually, you're being arrogant and the computers are being arrogant to plan my child's death, right? So, there's cultures, religious scripture, many things that we have to consider when we share information.* (P10)

In other words, in addition to respecting and acknowledging each individual's' personal needs, being aware of cultural aspects and context is practically helpful in supporting effective clinician-patient communication, ultimately leading to a successful implementation of MPAs in EoL care. Therefore, a culturally sensitive and culturally informed approach is needed when designing and implementing MPAs in EoL care:

> *I think it kind of comes back to, like, the team being trained to have these conversations. But also a culturally sensitive way, right? from a lens of cultural humility. And also like, assessing what is the culture of this patient and this family? What have they understood so far?* (P3)

Participants agreed that using MPAs in EoL care may add challenges to clinician-patient communication. Predictive algorithms "*would certainly sort of complicate the discussion*" in EoL care given that "*certain cultures and backgrounds act differently at the end of life than others"* (P4), one clinician assumed. At the same time, using MPAs in EoL care could ease the burden on clinicians when discussing life expectancy with patients, allowing them to avoid being blamed as "*discrediting their religious beliefs"* (P10):

> *I think that having AI can help, it's not me trying to say 'I want the bed for someone else.' It's not me saying 'I discredit your religious beliefs.' It's not me saying anything. This is just, you know, when we look at the AI algorithm, it says this, and it's just information and people will choose to use that or not in their decision making.* (P10)

Briefly, the discussion of concerns on the broader societal level reflects participants' view that society has a collective responsibility to ensure that AI tools serve the public good, working in the best interest of patients and families while remaining attentive to their cultural and spiritual needs.

DISCUSSION

While other studies have explored HCPs' views on using AI for various conditions including palliative care (18,20-22,25,39), there remains a paucity of qualitative studies exploring HCPs' ethical considerations of integrating AI into EoL care. Existing literature on implementing predictive analytic technologies in various areas of medicine focuses on increasing model robustness, reducing bias, and improving diagnostic capability (7,16,20,28,39-45); there is relatively little attention on the ethics of using AI models to assist with clinical practice in the sensitive context of the final stages of a patient's life (4). As AI algorithms are increasingly developed and promoted as resources to enhance care that may change health care delivery, our study provides a multi-level framework that can inform best practices.

Our interviews with physicians and nurse practitioners regarding their perspectives on the ethical dimension of integrating AI-enabled prognostic tools in EoL care revealed a consistent but nuanced tension related to using this emerging technology in a deeply sensitive area of care. Consistent with previous studies (18,45,46), many clinicians viewed AI prognostic tools as holding potential to enhance care through improved predictive accuracy and resource planning. However, this optimism was juxtaposed against concerns about the transparency, reliability, applicability, and implementation of these models in real-world settings. Skepticism, a sentiment that was also expressed by clinicians in prior research (20,21), was based on potential technical limitations (e.g., data representation, accuracy, bias) as well as moral and relational questions about whether AI can (or should) support human prognostication in the evolving therapeutic and socio-technological space.

As participants discussed their optimism and caution about broader relational, interprofessional, organizational, and societal implications of increasingly relying on AI for EoL care, a unifying theme emerged: regardless of its promise, AI cannot and should not replace the human relational components needed in providing and organizing EoL care. Communication strategies around prognosis remain deeply personal, and over-reliance or over-confidence on AI might erode the value of clinical intuition and relational aspects of empathetic engagement. These findings echo concerns reported in previous research about diminished human clinical judgment and human-to-human interaction from over-relying on AI tools, and support the existing argument that AI, including MPAs, cannot and should not replace but augment the human connection (15,28,29,47). In addition, concerns were raised about the intersection between MPAs and system- or institution-level drivers (e.g., cost-saving imperatives, funding arrangements), and how these may influence implementation practices across health institutions, with downstream implications for patients and care quality. For example, MPAs have been designed and used by health systems to decrease healthcare expenses. These include pinpointing high-cost patients, lowering readmission rates, and forecasting worsening patient's condition (decompensation) (48-50). These institutional priorities of improving organizations' financial performance, including the possibility of denying treatments and services based on mortality predictions as some participants mentioned, may be non-transparent to patients and families. They may conflict with patients' and families' interests and goals, or restructure EoL care and how we evaluate quality of care. Therefore, there is an urgent need for regulatory oversight to address and deal with this clear tension, ensuring patients' interests are always protected. We also need more attention to the political economy of MPAs, by recognizing that different stakeholders may have divergent interests and unequal access to resources and power in the delivery of EOL care, and intentionally addressing or preventing such inequities.

The multiple interconnecting layers of individual, professional, organizational and societal concerns provide a helpful framework to understand clinicians' perspectives of developing and implementing life expectancy algorithms in EoL care. In particular, we highlight three key and overlapping observations brought on by our findings: 1) Redefining clinicians' role in the evolving techno-therapeutic environment; 2) Navigating EoL hope in the age of predictive tools; and 3) Promoting a balanced and holistic approach to EoL care in the rapidly evolving AI space.

Redefining the Clinician's Role in the Evolving Techno-Therapeutic Environment

A significant theme underlying all interviews centred on whether or how AI predictive models may affect clinicians' roles and responsibilities in EoL care. There is a general concern within healthcare about the use of AI potentially leading to the abrogation of the patient-clinician relationship. While these issues are not unique to mortality predictions, they may be especially salient in the final stages of life, when patients are often at their most vulnerable. On the one hand, participants suggested that AI outputs may simply provide more comprehensive or accurate information to enhance rather than alter clinicians' humanistic roles (51-53). Even though participants expected and wanted AI predictive tools to provide additional and accurate clinical insights, they considered these models as supplementary or complementary informational tools. They were not a replacement for their own expert judgment and therapeutic responsibilities of assessing their patients' emotional readiness or preferred ways to receive such information and communicating such information with sensitivity and compassion. Life expectancy models may nudge goals of care conversations, but they are not themselves communication tools that can address multifaceted concerns for patients or families facing weighty decisions in an existentially vulnerable time. Clinicians still need to engage with their patients in balancing various priorities and clinical realities to determine the most appropriate care plan (54).

However, participants' concerns about clinician readiness and education gaps in both AI and EoL conversations point to an important limitation. If clinicians have not already been trained to engage in these conversations in sensitive and respectful ways, AI prognostication tools that present quantifiable predictions may not, on their own, address patients' qualitative experience or enhance compassionate conversations about their hopes, expectations, worries, and goals, and sources of comfort as they weigh different care options in a distressing time. These tools also do not address underlying concerns that many health systems do not provide necessary time and space for therapeutic presence and relational support for those who are facing anticipatory grief and existential angst as they potentially approach the end of their natural life. Worse yet, EoL discussions are often emotionally challenging for clinicians. This raises the concern that some may refrain from initiating goals-of-care discussions until prompted by the AI algorithm, even when other signs suggest that the patient could benefit from such conversations. These signs might include the patient talking about family members' illness experiences, or expressing fears about their own health decline (54). Indeed, clinicians in other studies expressed concerns about clinician readiness, especially a lack of education, training and even knowledge about clinical AI (18,21,34). There are also broader philosophical concerns about epistemic injustice. If quantifiable data are presumed to override physicians' broader qualitative judgment, as well as patients' own subjective embodied experience, AI outputs may be granted more credibility than they deserve. This may also downplay the significance of patients' and families' contextual and phenomenological experiences when considering how to support patients and their loved ones in existentially sensitive times (54).

As AI models of variable performance become more prevalent in health care, participants also questioned if AI prognostic tools might alter or redefine their roles and responsibilities in other ways, positioning clinicians more as interpreters, mediators, and stewards of prognostic information rather than therapeutic partners. While participants advocated for thoughtful implementation and integration of AI with human oversight to minimize bias, inaccuracy, or unintended harms, some reported a low level of familiarity with AI health tools. As there continues to be a lack of education for HCPs on how various types of AI models work

(1,18,34), questions abound regarding who should provide such oversight at the point of care, or how clinicians who are unfamiliar with AI models' analytical process or performance may support or educate patients or families regarding algorithmic outputs. Moreover, AI models are increasingly being presented as epistemically equal, or even superior, to human clinicians, particularly in predictive and diagnostic ability (10,13,14). Participants also voiced concerns about erosion of clinical skills as reliance on AI expands. Together these concerns raise epistemic and institutional questions about whether clinicians should trust their own judgment rather than follow machine recommendations in situations of prognostic disagreement, and what guidelines health care institutions should provide for these scenarios. This question becomes more critical given the possibility of AI-based tools perpetuating biases in palliative care (55) or even misleading HCPs (56). Although it is recommended that clinicians treat AI tools as a supplement to rather than replacement of their judgment (4), there is a risk that some clinician will rely unquestioningly on MPA results. This concern becomes increasingly relevant given that some clinicians may be prone to automation bias, accepting erroneous machine decisions over their judgment and interpretation (57), or follow their recommendations even when they contradict the clinician's initial impressions (56).

Navigating EoL Hope in the Age of Predictive Tools

These findings intersect with broader questions about how HCPs' roles may evolve as AI becomes more integrated into clinical care (20,47). They also show how the dominant focus on model accuracy and fairness in AI ethics discourse misses other important humanistic elements of EoL care and communication. These include the need to reinforce therapeutic alliance, uphold hope, and provide a healing presence in the face of a grim prognosis (58-60). Repeating similar calls in other studies where both clinicians and patients questioned AI tools' validity and asked for more evidence (21,61), several participants explained that trust in AI required seeing sustained evidence of clinical benefit. However, clinical benefits of prognostication are not simply about algorithmic accuracy of a patient's life expectancy based on clinical criteria. Indeed, participants expressed varying views about would generally provide a more "truthful" result. Some pointed to AI models that promise to approximate a ground truth through large-scale data analysis. Others emphasized human clinicians, whose prognostic assessments are grounded in expert judgment shaped by bedside observation, patient context, and intuition. Many described elements of prognosis as being unquantifiable, and that attention to the qualitative and biopsychosocial dimensions of death and dying is necessary to promote a more holistic, patient-centred approach to EoL care (28,62,63). Some participants also expressed a need for epistemic humility for both humans and machines even in the face of striving for better accuracy, acknowledging the inherent uncertainty of predicting death.

Recognizing the complex interplay between clinical, spiritual, and relational dimensions of EoL experience and expectations, participants reflected thoughtfully on how AI-guided prognostic information — even if highly accurate — might affect patient hope, underscoring the highly individualized nature in which AI tools should be deployed in EoL care. While some had concerns that AI prognostication could eliminate hope, others thought these tools may help patients reframe hope. Participants emphasized that how information is communicated is just as important as what is shared (60). A thoughtful, compassionate approach was described as a way to preserve a patient's sense of agency and hope, even in the face of a difficult prognosis. Our findings illuminate hope as a dynamic and multifaceted aspect of patient wellbeing, that is shaped by socio-relational context, timing, clinician/patient readiness, and communication style. How the prognostication prediction is reached, considered alongside other individual and institutional factors, and communicated by clinicians may affect the therapeutic alliance and patients' care experience (64). While prognostication algorithms may provide additional data to support goal-concordant care plans, mortality prediction and associated communication may alter the patients' and families' identity and hope narrative (59), as well as clinicians' approach to, and view of, the significance and meaning of hope for terminally ill patients (65). These findings highlight the important role clinicians have when interpreting and conveying prognostic data from AI tools so that hope can be preserved or reimagined in ways that align with patients' needs.

Promoting a Balanced and Holistic Approach to EoL Care in the Evolving AI Space

An overarching finding of this study is the need for a balanced, carefully thought-out approach to integrating AI prognostic tools to promote benefits and minimize harm for patients and their families. Ideally, this approach would maintain the human element at the centre of care, brought forth by thoughtful implementation at the institutional level to support patients, families, and clinicians who must collaborate in determining and providing the most appropriate EoL care plan. This conclusion supports calls in previous studies for a balanced approach between AI-assisted tools and human aspects, an approach described as key for successful implementation of such tools, especially in palliative care (1,28,29).

Much of the research on AI-assisted predictive models in healthcare, and reviews of AI integration and use in palliative care specifically, focus on technical aspects such as efficiency and accuracy. While efficiency and accuracy are helpful, they are inadequate to provide high quality care (4,15,28). AI tools must be integrated within a holistic system that considers the complexity of patient experiences and therapeutic relationships in the changing AI landscape. Cultural and religious diversity, as well as different worldviews and metaphysical frameworks, shape how patients and families understand whether the timing of death can and should be calculated, quantified, or made transparent. These differences add further ethical dimensions to the pursuit of equitable, humanistic, and respectful care as technologies continue to mediate clinical practice. They also

underscore the need for patient-specific approaches to integrating AI prognostic tools in EoL care (1).[2] In other words, this paper argues for moving beyond a focus on mortality estimations to look at the complexity of patients' experiences in EoL, while being attentive to their personal needs, values, and preferences (14,28). Further, participants described an appropriate implementation process as one that includes education for both clinicians and patients, clear organizational policies (such as around consent processes) and workflow integration that is mindful of existing system constraints. These reflections echo what has been highlighted in the literature about the necessity of training and education about AI prognostic tools and their use in healthcare (1,34).

Participants' discussions about consent reflect a broader concern of whether valid and informed consent can be obtained from patients when MPAs with varying and uncertain levels of accuracies are used in EoL care. Indeed, the integration of AI-driven technologies in healthcare raise questions about whether current approaches and frameworks are even suitable (66,67). The "black box" nature of AI systems, their lack of explainability, clinicians' limited understanding of AI technologies and how these technologies work, and uncertainty about potential outcomes all constrain clinicians' ability to inform patients adequately. These constraints are especially significant when clinicians must explain the risks and implications of AI-driven medical decisions. Further, they complicate the application of traditional consent processes and standard disclosures of information in medicine, raising concerns about ethical and legal compliance of current consent forms (66,68). A shift is needed in understanding of and approaches to consent, anchored in a more suitable ethical framework that is aligned with and applicable to the rapidly evolving applications of AI in healthcare (66-68). Examples of initial steps that could help clinicians convey complex AI information to patients and obtain proper informed consent are: personalized consent forms, visual aids, and using plain language (66,67). Additionally, comprehensive training programs for HCPs on how AI systems work and how to interpret their outputs and communicate their findings, were also suggested to assist with obtaining consent and increasing patients' trust in decisions and results of AI models generally (66,68). As AI involvement in medicine becomes the new normal, as many believe (69), it is realistic to assume that providing care will involve AI. Thus, it may be more practical to train HCPs to explain, in general terms, how AI models work, rather than requiring them to provide detailed explanations of prediction results in each case. At the same time, institutions must ensure that any AI tool used in clinical care meets applicable ethical and legal standards (69).

Organizational readiness emerged as a critical factor: leadership commitment and approaching the integration of AI tools as part of a broader change-management process are key to ensuring these tools support, rather than burden, clinicians. Our findings highlight the pressing need for clear ethical guidelines, robust regulatory frameworks, and interdisciplinary collaboration to ensure the ethical and effective implementation of MPAs in EoL care, aligning treatment with patients' goals (15,20,70).

Canada's publicly funded healthcare system provides important context for interpreting these findings. As Canadian patients generally do not need to consider out-of-pocket costs when receiving treatment, decision-making around EoL care is more often shaped by factors beyond financial pressure. This differs from countries with different funding models, such as the United States, where insurance coverage and personal expenses have a major influence over HCPs' treatment recommendations and an individual's decision to access palliative care. Consequently, the implications of our findings must be considered within a system that prioritizes equitable access to care and operates largely independent of an individual's ability to pay. Yet while the financial burden of care may not play a large role in a patient's decision-making process, the shortage of palliative care services across Canada remains a significant challenge. According to the Palliative Care Coalition of Canada (71), only 58% of Canadians who could benefit from palliative care are able to access it, which is particularly relevant to the integration of MPAs. While MPAs have the potential to promote earlier identification of patients who may benefit from palliative care, they also highlight a tension between the identified need for care and the ability to provide it in a resource-constrained system. Situating the findings of this study within this context underscores the importance of developing approaches that align with the realities of palliative care delivery in Canada.

LIMITATIONS AND FUTURE DIRECTIONS

The current study has some limitations. First, the sample includes a relatively small number of participants which limits the generalizability of results. This exploratory empirical research sought to explore ethical aspects of MPAs use in EoL thorough in-depth understanding of research participants' perspectives and narrative. It is not intended to generalize or represent the perspectives of all clinicians, but to serve as a first step to informing future research on this topic. Such research should include a wider variety of clinicians with different backgrounds, expertise, and from other geographic locations inside and outside of Canada. Second, our study did not include patients and families. Exploring those experiences and perspectives of MPA use in EoL is crucial for gaining a deeper understanding of this topic. Third, a thorough philosophical discussion of the phenomenology of serious illness and metaphysical frameworks around the knowability of death was beyond the scope of this empirical paper. Additional research in these areas could provide insight into how MPAs represent not simply a technological but also metaphysical shift in EoL care.

[2] We thank a reviewer's insightful reminder of these considerations.

CONCLUSIONS

Algorithms and AI models now exist to aid clinicians in more accurately predicting mortality. This article examined HCPs' perceptions and attitudes towards the use of these technologies in EoL care. Our findings demonstrated that clinicians have both positive attitudes and concerns around integrating MPAs in medicine. They raised important questions about how MPAs should be designed and implemented, including the goals of these technologies, their potential outcomes, and whether improving accuracy is enough for improving quality of care. Our study demonstrated that mortality prediction and related tools can influence patients' and families' experiences, reshape HCPs' roles and daily practices, and affect healthcare systems and services. By analyzing HCPs' perspectives and perceptions of the ethical dimensions and multi-level considerations, our study provided a holistic view that reflects the complex needs and experiences of patients in EoL care, and highlights the need to move beyond focusing on mortality estimations and accurate predictions. MPAs have a potential to support HCPs and the healthcare system in managing EoL care. However, ethical implications at the individual, professional, organizational, and societal levels must be considered for successful integration and implementation of these tools. Further, considering these intersecting multi-level ethical dimensions is key for ensuring best clinical practices that align with both patients' goals and values as well as clinicians' concerns and needs. Maintaining human clinical judgment and the human element in therapeutic relationships, and preserving hope, are also essential for enhancing quality of care in the sensitive context of the final stages of a patient's life. Drawing on this holistic and multi-level perspective can help in developing ethical frameworks for ensuring ethical integration of AI in sensitive health contexts such as EoL care.

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REFERENCES

1. Adegbesan A, Akingbola A, Ojo O, et al. Ethical challenges in the integration of artificial intelligence in palliative care. J Med Surg Public Health. 2024;4:100158.
2. World Health Organisation. Strengthening of palliative care as a component of integrated treatment within the continuum of care. WHO. 20 Dec 2013.
3. Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Heal J. 2019;6(2):94-8.
4. Oh O, Demiris G, Ulrich CM. The ethical dimensions of utilizing Artificial Intelligence in palliative care. Nurs Ethics. 2025;32(4):1285-96.
5. Rajkomar A, Oren E, Chen K, et al. Scalable and accurate deep learning with electronic health records. Npj Digit Med. 2018;1:18.
6. Elfiky AA, Pany MJ, Parikh RB, Obermeyer Z. Development and application of a machine learning approach to assess short-term mortality risk among patients with cancer starting chemotherapy. JAMA Netw Open. 2018;1(3):e180926.
7. Cary MP, Zhuang F, Draelos RL, et al. Machine learning algorithms to predict mortality and allocate palliative care for older patients with hip fracture. J Am Med Dir Assoc. 2021;22(2):291-6.
8. Wang L, Sha L, Lakin JR, et al. Development and validation of a deep learning algorithm for mortality prediction in selecting patients with dementia for earlier palliative care interventions. JAMA Netw Open. 2019;2(7):e196972.

9. Blom MC, Ashfaq A, Sant'Anna A, Anderson PD, Lingman M. Training machine learning models to predict 30-day mortality in patients discharged from the emergency department: a retrospective, population-based registry study. BMJ Open. 2019;9(8):e028015.
10. Thorsen-Meyer HC, Nielsen AB, Nielsen AP, et al. Dynamic and explainable machine learning prediction of mortality in patients in the intensive care unit: a retrospective study of high-frequency data in electronic patient records. Lancet Digit Health. 2020;2(4):e179-91.
11. Naemi A, Schmidt T, Mansourvar M, et al. Machine learning techniques for mortality prediction in emergency departments: a systematic review. BMJ Open. 2021;11(11):e052663.
12. Romero-Brufau S, Wyatt KD, Boyum P, et al. Implementation of artificial intelligence-based clinical decision support to reduce hospital readmissions at a regional hospital. Appl Clin Inform. 2020;11(4):570-7.
13. Avati A, Jung K, Harman S, et al. Improving palliative care with deep learning. BMC Med Inform Decis Mak. 2018;18(S4):122.
14. De Panfilis L, Peruselli C, Tanzi S, Botrugno C. AI-based clinical decision-making systems in palliative medicine: ethical challenges. BMJ Support Palliat Care. 2023;13(2):183-9.
15. Feldman E, De Cremer D. Preserving physician ethics in the era of autonomous AI. AI Ethics. 2025;5(3):3415-20.
16. Parikh RB, Manz C, Chivers C, et al. Machine learning approaches to predict 6-month mortality among patients with cancer. JAMA Netw Open. 2019;2(10):e1915997.
17. Kubi B, Istl AC, Lee KT, Conca-Cheng A, Johnston FM. Advance care planning in cancer: patient preferences for personnel and timing. JCO Oncol Pract. 2020;16(9):e875-83.
18. Postill G, Dent A, Dombroski J, et al. Perspectives of family medicine residents on artificial intelligence for survival estimation in patients with serious illness. PLOS Digit Health. 2025;4(7):e0000917.
19. Parikh RB, Hasler JS, Zhang Y, et al. Development of machine learning algorithms incorporating electronic health record data, patient-reported outcomes, or both to predict mortality for outpatients with cancer. JCO Clin Cancer Inform. 2022;6:e2200073.
20. Petersson L, Vincent K, Svedberg P, Nygren JM, Larsson I. Ethical considerations in implementing AI for mortality prediction in the emergency department: linking theory and practice. Digit Health. 2023;9:20552076231206588.
21. Hildebrand RD, Chang DT, Ewongwoo AN, Ramchandran KJ, Gensheimer MF. Study of patient and physician attitudes toward automated prognostic models for patients with metastatic cancer. JCO Clin Cancer Inform. 2023;7:e2300023.
22. Blease C, Kaptchuk TJ, Bernstein MH, et al. Artificial intelligence and the future of primary care: exploratory qualitative study of uk general practitioners' views. J Med Internet Res. 2019;21(3):e12802.
23. Petch J, Di S, Nelson W. Opening the black box: the promise and limitations of explainable machine learning in cardiology. Can J Cardiol. 2022;38(2):204-13.
24. Ahmad O, Mason S, Stanley S, Nwosu AC. Exploring perspectives of healthcare professionals on AI in palliative care: Qualitative interfview study. JMIR Hum Factors. 2025;12:e79514.
25. Krishnamurthy N, Besculides M, Gorbenko K, et al. Multidisciplinary clinician perceptions on utility of a machine learning tool (ALERT) to predict 6-month mortality and improve end-of-life outcomes for advanced cancer patients. Cancer Med. 2025;14(5):e70137.
26. Tyskbo D, Nygren J. Reconfiguration of uncertainty: introducing AI for prediction of mortality at the emergency department. Soc Sci Med. 2024;359:117298.
27. Char DS, Abràmoff MD, Feudtner C. Identifying ethical considerations for machine learning healthcare applications. Am J Bioeth. 2020;20(11):7-17.
28. García Abejas A, Geraldes Santos D, Leite Costa F, et al. Ethical challenges and opportunities of ai in end-of-life palliative care: integrative review. Interact J Med Res. 2025;14:e73517.
29. Munive Jesus U. Incorporating artificial intelligence in palliative care: opportunities and challenges. Hosp Palliat Med Int J. 2024;7(3):81-3.
30. Vu E, Steinmann N, Schröder C, et al. Applications of machine learning in palliative care: a systematic review. Cancers. 2023;15(5):1596.
31. WHO Guidance. Ethics and Governance of Artificial Intelligence for Health. Geneva: World Health Organization; 2021.
32. Independent High-Level Expert Group on Artificial Intelligence. Ethics Guidelines for Trustworthy AI. European Commission. 8 Apr 2019.
33. Cagliero D, Deuitch N, Shah N, Feudtner C, Char D. A framework to identify ethical concerns with ML-guided care workflows: a case study of mortality prediction to guide advance care planning. J Am Med Inform Assoc. 2023;30(5):819-27.
34. Corfmat M, Martineau JT, Régis C. Hi-reward, high-risk technologies? An ethical and legal account of AI development in healthcare. BMC Med Ethics. 2025;26:4.
35. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77-101.
36. Creswell JW. Qualitative Inquiry and Research Design: Choosing Among Five Approaches. Los Angeles: SAGE; 2013.
37. Flick U. An Introduction to Qualitative Research. Los Angeles: Sage; 2014.
38. Ho A, Bavli I, Mahal R, McKeown MJ. Multi-level ethical considerations of artificial intelligence health monitoring for people living with parkinson's disease. AJOB Empir Bioeth. 2023;15(3):178-91.
39. Manz CR, Chen J, Liu M, et al. Validation of a machine learning algorithm to predict 180-day mortality for outpatients with cancer. JAMA Oncol. 2020;6(11):1723-30.

40. Gajra A, Zettler ME, Miller KA, et al. Augmented intelligence to predict 30-day mortality in patients with cancer. Future Oncol. 2021;17(29):3797-807.
41. Lu SC, Xu C, Nguyen CH, et al. Machine learning-based short-term mortality prediction models for patients with cancer using electronic health record data: systematic review and critical appraisal. JMIR Med Inform. 2022;10(3):e33182.
42. Kourou K, Exarchos TP, Exarchos KP, Karamouzis MV, Fotiadis DI. Machine learning applications in cancer prognosis and prediction. Comput Struct Biotechnol J. 2015;13:8-17.
43. Beeksma M, Verberne S, Van Den Bosch A, et al. Predicting life expectancy with a long short-term memory recurrent neural network using electronic medical records. BMC Med Inform Decis Mak. 2019;19:36.
44. Motwani M, Dey D, Berman DS, et al. Machine learning for prediction of all-cause mortality in patients with suspected coronary artery disease: a 5-year multicentre prospective registry analysis. Eur Heart J. 2017;38(7):500-7.
45. Ahmed MI, Spooner B, Isherwood J, et al. A systematic review of the barriers to the implementation of artificial intelligence in healthcare. Cureus. 2023;15(10):e46454.
46. Parikh RB, Manz CR, Nelson MN, et al. Clinician perspectives on machine learning prognostic algorithms in the routine care of patients with cancer: a qualitative study. Support Care Cancer. 2022;30(5):4363-72.
47. Hazarika I. Artificial intelligence: opportunities and implications for the health workforce. Int Health. 2020;12(4):241-5.
48. Bates DW, Saria S, Ohno-Machado L, Shah A, Escobar G. Big data in health care: Using analytics to identify and manage high-R\risk and high-cost patients. Health Aff. 2014;33(7):1123-31.
49. Teo K, Yong CW, Chuah JH, et al. Current trends in readmission prediction: An overview of approaches. Arab J Sci Eng. 2023;48(8):11117-34.
50. Liu W, Stansbury C, Singh K, et al. Predicting 30-day hospital readmissions using artificial neural networks with medical code embedding. Liu N, editor. PLOS ONE. 2020;15(4):e0221606.
51. Topol EJ. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. New York: Basic Books; 2019.
52. Lim LJ, Tison GH, Delling FN. Artificial intelligence in cardiovascular imaging. Methodist DeBakey Cardiovasc J. 2020;16(2):138-45.
53. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med. 2019;25(1):44-56.
54. Ho A. Live Like Nobody Is Watching: Relational Autonomy in the Age of Artificial Intelligence and Health Monitoring. New York: Oxford University Press; 2023.
55. Akhras N, Antaki F, Mottet F, et al. Palliative Care Adversarial Dataset (PCAD). figshare; 2025.
56. Tschandl P, Rinner C, Apalla Z, et al. Human–computer collaboration for skin cancer recognition. Nat Med. 2020;26(8):1229-34.
57. Bond RR, Novotny T, Andrsova I, et al. Automation bias in medicine: the influence of automated diagnoses on interpreter accuracy and uncertainty when reading electrocardiograms. J Electrocardiol. 2018;51(6):S6-11.
58. Love CS. "Just the facts ma'am": moral and ethical considerations for artificial intelligence in medicine and its potential to impact patient autonomy and hope. Linacre Q. 2023;90(4):375-94.
59. Laranjeira C, Dixe MA, Semeão I, et al. "Keeping the light on": a qualitative study on hope perceptions at the end of life in portuguese family dyads. Int J Environ Res Public Health. 2022;19(3):1561.
60. Kirk P, Kirk I, Kristjanson LJ. What do patients receiving palliative care for cancer and their families want to be told? A Canadian and Australian qualitative study BMJ. 2004;328(7452):1343.
61. Young AT, Amara D, Bhattacharya A, Wei ML. Patient and general public attitudes towards clinical artificial intelligence: a mixed methods systematic review. Lancet Digit Health. 2021;3(9):e599-611.
62. Balasubramanian S, Devarajan H, Raparthi M, et al. Ethical considerations in ai-assisted decision- making for end-of-life care in healthcare. Power Syst Technol. 2023;47(4):167-82.
63. Kamdar M, Lakin J, Zhang H. Artificial intelligence, machine learning, and digital therapeutics in palliative care and hospice: the future of compassionate care or rise of the robots? (TH363). J Pain Symptom Manage. 2020;59(2):434-5.
64. Ho A, Brake J, Palmer A, Binkley C. A holistic, multi-level, and integrative ethical approach to developing machine learning-driven decision aids. Am J Bioeth. 2024;24(9):110-3.
65. Mok E, Lau K, Lam W, Chan L, Ng J, Chan K. Health-care professionals' perspective on hope in the palliative care setting. J Palliat Med. 2010;13(7):877-83.
66. Chau M, Rahman MG, Debnath T. From black box to clarity: strategies for effective AI informed consent in healthcare. Artif Intell Med. 2025;167:103169.
67. Moulaei K, Akhlaghpour S, Fatehi F. Patient consent for the secondary use of health data in artificial intelligence (AI) models: a scoping review. Int J Med Inf. 2025;198:105872.
68. Wang Y, Ma Z. Ethical and legal challenges of medical AI on informed consent: China as an example. Dev World Bioeth. 2025;25(1):46-54.
69. Pruski M. AI-enhanced healthcare: not a new paradigm for informed consent. J Bioethical Inq. 2024;21(3):475-89.
70. Ferrario A, Gloeckler S, Biller-Andorno N. Ethics of the algorithmic prediction of goal of care preferences: from theory to practice. J Med Ethics. 2023;49(3):165-74.
71. Palliative Care Coalition of Canada. Blueprint for Action: 2025–2030. PCCC; 2025.

APPENDIX 1: CLINICAL PROVIDERS' PERSPECTIVES ON THE ETHICAL IMPLICATIONS OF UTILIZING MORTALITY PREDICTION ALGORITHMS IN END-OF-LIFE CARE

Semi-Structured Interview Guide

Introduction

Thank you for being interested in our study on clinical providers' perspectives on using predictive algorithms in end-of-life care. There are already some algorithms out there that claim to be able to accurately predict the likelihood that a patient will die within 6-12 months by scouring over a patient's electronic medical record. For our interview study, we want to think about life expectancy prognostication algorithms in general. We will start by getting your initial thoughts on using AI algorithms to predict life expectancy for seriously ill patients, and then more specifically about what you think are potential benefits and concerns. You may share how you think the use of these types of algorithms may affect individual patients, your professional practice, or end-of-life care in general. Do you have any questions before we begin?

Interview Questions

1. Have you used any predictive algorithms in your medical practice? (If yes, please explain/elaborate.)

2. When you hear about AI mortality prediction algorithms, what are your initial thoughts about using these types of technology in end-of-life care?
    a. How do you think they differ from other clinical decision algorithms you are familiar with? (e.g., APACHE scores)
    b. Are you aware of your institution or other institutions using AI mortality predictive algorithms? (If yes, please explain/elaborate.)

3. In end-of-life care, when do you think AI mortality predictive algorithms might be most useful? Least useful or most concerning?
    a. Institutional, operational, and individual patient levels

4. What factors would you consider in determining whether to use AI mortality predictive algorithms in your clinical work?
    a. How might you use the information from these algorithms in patient care?
    b. How might these algorithms affect your clinical practice or end-of-life care?

5. Suppose your hospital or clinic is using AI mortality prediction algorithms.
    a. What should institutions and clinicians disclose to patients/surrogates regarding the use of these algorithms?
    b. What would be ethical ways to disclose or share information about the use of AI and the AI predictions to patients or their surrogate decision makers?

6. What ethical concerns do you have regarding using mortality prediction algorithms in end-of-life care?
    a. E.g., bias, accuracy, self-fulfilling prophecy.
    b. Any other concerns?

7. (If not yet discussed in Q6) How do you think clinicians should deal with conflicts that may arise from using these algorithms?
    a. Clinicians disagreeing with their institution's expectations to use these algorithms.
    b. Clinicians questioning algorithmic predictions.
    c. Patients/surrogates disagreeing with algorithmic predictions.

8. Assuming that these algorithms are accurate, how do you think various stakeholders may think about them being used in direct patient care?
    a. Patients/families
    b. Clinics/hospitals
    c. Health authorities
    d. Health/Life insurance companies