TITLE: What Does Artificial Intelligence Mean for Oncologists?

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ABSTRACT

Recent developments with artificial intelligence (AI) and cancer care suggest that AI has far reaching implications for the field. Such developments bring with them many ethical challenges for the oncologist. When integrating AI into patient care, oncologists can start with Beauchamp and Childress' framework of biomedical ethics to consider ethical issues that AI can pose, such as challenges related to informed consent, preventing harm from bias, and the potential to reinforce structural inequities. In using AI, the greatest ethical imperative for the oncologist is to have an in-depth understanding of the technology being used. Understanding the AI being used in patient care will help oncologists navigate the myriad ethical problems associated with it.

Artificial Intelligence or “AI” has become a buzzword in recent years. Medical practitioners may find themselves wondering what AI could mean for their professions and their patients. Here we review briefly some developments of AI in oncology both in research and in practice, and highlight some ethical questions that AI use in cancer care poses for oncologists.

AI is an umbrella term for many different methodologies within data science that aim to build and understand entities that have intelligence.¹ It is no surprise that a PubMed search of “artificial intelligence” and “cancer” displays thousands of publications. Headlines of journal articles such as “*A New Era: Artificial Intelligence and Machine Learning in Prostate Cancer*” suggest that cancer care is on the brink of an AI revolution.² A review of the top 100 most cited journal articles about medical artificial intelligence found that the majority of clinical studies were related to cancer.³ The authors explain that, in addition to cancer having a large disease burden globally, oncology lends itself to the use of AI with its large datasets of information on topics such as genomics and metabolics.³ Already, research has suggested that AI can identify skin lesions on par with dermatologists,⁴ and lung⁵ and breast⁶ cancers better than clinicians.

Beyond the research realm, AI is already being used in oncology practice. Of the AI products that have received licenses from Health Canada, iCAD’s ProFound AI is an example of an application that can be used to detect breast cancer.⁷ According to its website, iCAD is used in over 3500 health care facilities around the world to help detect breast cancer using several products.⁷ Another example of AI in oncology is a methylation based classifier system developed by researchers in Germany.⁸ This system enables physicians to upload a methylation profile of a biopsy and instantly receive a subclassification for the tumor.⁸ While according to the website, the tool is meant for research and is not clinically validated, the AI has been approved for use in New York State, and is being used globally up to 1000 times a month.⁸ The dataset now consists

of 60 000 tumours, more than any pathologist could see in a lifetime, and is thus capable of finding new classifications.⁸ Not all products seem as promising, however. An example of a medical application of AI which ran into difficulties is IBM's Watson for Oncology. In 2017, *STAT News* published a report concluding that Watson for Oncology, expected to revolutionize cancer care, had fallen short of its promises by making recommendations that may have been biased toward the input of several American doctors which had worked on training the algorithm.⁹

The surge of AI cancer research and products underscore the importance of considering the ethical implications of introducing AI into oncology. The four principles of Beauchamp and Childress' biomedical ethics - autonomy, non-maleficence, beneficence, and justice¹⁰ - may be an overly simplistic framework for the field bioethics, but these principles can serve as a starting point for any oncologist who is faced with integrating the use of AI into their practice.

Autonomy, or the patient's right to self determination, is a principle that ensures that patients are properly informed about their medical care so they can make decisions that are right for them.¹⁰ Little has been written about how to navigate informed consent when using AI in a patient's medical care, and the default position of many health practitioners has been not to disclose information about AI being used in a patient's care.¹¹ As bioethicists such as Professor I. Glenn Cohen continue to wrestle with the ethical and legal dimensions of informed consent with AI,¹² oncologists should err on the side of caution and practice disclosing information to patients about the AI being used in their care. This is because patients may make different choices with the information that AI is being used in their care. Currently, when a radiologist interprets a scan or a pathologist classifies a tumor, a patient can rest assured that these physicians have completed years of training and licensing to become competent. If patients knew that AI was

being used to determine their diagnosis or prognosis, some of them may feel uncomfortable and decide to seek a second opinion. While some patients may welcome the developments of AI into their care, or not give them much thought, others may be concerned, and change their behavior accordingly. In order to be able to inform patients about how AI is being used, oncologists will first need to have an in-depth understanding of the AI itself. Oncologists will need to understand the evidence that supports the use of the product that they intend to use, including the type and extent of data on which it was trained, and be able to convey relevant information to patients in order to help patients make informed decisions.

Non-maleficence can be thought about as the “do no harm” principle, while beneficence, the other side of the coin, is the “do good” principle.¹⁰ While AI in oncology has much potential for benefiting patients, including more accurate diagnosis and prognosis, it can also lead to harm. Mathematical models rely on assumptions about their data, and if the assumptions are biased or otherwise erroneous, patients may not receive the best care. For example, an algorithm that predicts the risk of developing a cancer based on the scans of a small, homogenous sample size, may predict an inaccurate risk score for a particular patient. This may lead the patient to endure prophylactic procedures that they may not have otherwise undertaken with the more accurate risk prediction. Such problems of prognostication are not new to medicine,¹³ but AI has the potential to raise these issues on a wider scale.

The principle of justice is concerned with the fair allocation of resources.¹⁰ AI in oncology raises such issues with its potential to reinforce societal inequities. Consider the example of an algorithm that is trained on a dataset to develop a prognosis for a tumour. The AI identifies that one group of patients has a poor prognosis and will likely fail to benefit from additional interventions while the other group’s prognosis is promising with more intervention.

The physician might attribute this difference to some inherent biology of the tumours that only a machine learning algorithm trained on many data points can identify. However, in doing so, the physician may miss the potential for this difference in prognosis to be related to other factors such as socioeconomic status or a disparity in access to health care resources. In failing to recognize this, the oncologist would thus reinforce the outcome of the algorithm without recognizing their complicity in perpetuating structural societal causes of disease. It is crucial for any oncologist entrusting an algorithm to help them and their patients make decisions to understand the qualities of the dataset and consider which assumptions the AI is making to arrive at its decisions.

While oncologists have not been replaced by autonomous and omniscient machines, recent developments in AI and cancer suggest that more oncologists will cross paths with AI while caring for their patients. Along this path, many ethical issues will emerge, such as those related to informed consent, minimizing harm, and reinforcing inequitable societal structures. Oncologists can only confront these issues if they have an extensive understanding of the AI that they are using. It will be vital for oncologists to educate themselves on the use of any AI that they may employ in patient care. They will need to understand what evidence supports the AI's use, which assumptions any particular algorithm is making, and what data it is using to arrive at its end points. Making an effort to understand how AI is being used in patient care is an ethical imperative for today's oncologists.

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