The Use of Artificial Intelligence-based Technologies in Palliative Care: Advancing Patient Well-being at the End-of-life and Enhancing the Implementation of the Dying Patient Act

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ABSTRACT   In recent years, we have been experiencing a technological revolution, which signifies an ethical and societal transformation. Artificial intelligence (AI) based technologies have gradually permeated all aspects of life and solidified their position. Within this context, the emergence of these technologies offers new opportunities in the medical field, including palliative care, which is aimed at alleviating suffering and improving the quality of life for terminally ill patients and their families. In Israel, the Dying Patient Act of 2005 (the law), which promotes values such as the sanctity of life and individual autonomy, allows terminally ill patients to determine their preferred treatment, and withhold life-saving treatment under certain circumstances. The law represents a significant step toward improving care for terminally ill patients, reducing pain and suffering, and respecting the patient's wishes and worldviews in their final days. However, the practical implementation of the law has encountered numerous challenges, ranging from lack of familiarity among doctors and healthcare professionals and the requirement to determining life expectancy to fulfilling the law's purpose. These challenges are associated with ethical, cultural, and religious perspectives. In this article, we describe how AI-based technologies hold immense potential in applying the law and providing palliative care based on their predictive capabilities, prognostic accuracy, and optimization of treatment as well as communication between patients and healthcare providers. However, as an innovative, developing, and complex technology, it is crucial not to overlook the ethical, societal, and legal challenges inherent in implementing and using AI-based technologies in the context of palliative care.

IMAJ 2024; 26: 126–129

KEY WORDS: artificial intelligence (AI), Dying Patient Act, palliative care

We are at the heart of a technological revolution, inviting a value-based and social revolution. Technologies based on artificial intelligence (AI) have gradually penetrated all areas of life and established their position [1]. Meanwhile, the emergence of these technologies offers, among other things, new opportunities in the medical field, including palliative care, designed to alleviate suffering and improve the quality of life of terminally ill patients and their families.[2]

In this article, we argue that AI-based technologies have tremendous potential to implement the Dying Patient Act of 2005 (the law) in Israel and provide palliative care due to its ability to predict, make accurate prognosis, and optimize treatment and communication between patients and healthcare providers [3]. However, since it is an innovative, developing, and complex technology, the ethical, social, and legal challenges in implementing and using AI-based systems must be addressed. This article presents the potential of using AI-based systems for implementing the Dying Patient Act of 2005 [4] in providing tailored palliative care and discusses the broader implications of this technology.

THE DYING PATIENT ACT

The Dying Patient Act is intended, among other things, to regulate the medical treatment of a patient who is defined as *dying*, while balancing the values underlying the state of Israel as a Jewish and democratic state, specifically the sanctity of life, human dignity, and autonomy of the individual [5]. The law allows a patient who is at the end of life (EOL) and who meets the definitions of the law as a *terminally ill patient*, that is, one whose life expectancy does not exceed 6 months even if given medical treatment, to determine the course of treatment and to withhold life-saving treatment under some circumstances [6]. The law takes a significant step in improving the treatment of terminal-

ly ill patients to reduce pain and suffering and to respect their will and worldview in the last days of their lives [7]. By determining the continuation of treatment or the avoidance of treatment and protecting the clinical team in case of non-prolongation of life in situations where the law applies and according to the patient's wishes, the law constitutes a powerful regulation of EOL care in Israel in the absence of a comprehensive and consistent public discourse [8].

However, studies and public reports have shown that the law has inherent difficulties, and its implementation in practice encounters many obstacles and challenges. One of the most critical obstacles in the implementation of the law concerns the clinical difficulty of a *responsible doctor* to determine whether a patient is terminally ill as defined in the law and, more precisely, to determine that the patient's life expectancy does not exceed 6 months even if the patient is given medical treatment [7,9]. In November 2013, under the leadership of Minister of Health Yael German, the Israeli Ministry of Health established a public committee to examine the Dying Patient's Act and proposed removing the condition *even if given medical treatment* from the law's definition. Since the Minister of Health disbanded the committee, it did not complete its conclusions and no report was published.

From a medical perspective, the use of a life expectancy definition of 6 months is an inapplicable challenge to the law since such a definition cannot be applied to every disease and every medical condition. Patients suffering from an incurable disease do not necessarily fall under the protection of the law [9]. This matter leads doctors to feel that the law puts them in an impossible situation and that it does not correspond to clinical reality [10].

Other challenges in implementing the law are related to moral, cultural, and religious views regarding the EOL, such as the feeling of failure of a doctor who does not heal or extend life, and the difficulty of dealing with death and communicating with the patient and family members regarding the EOL [11].

Another challenge comes from the complexity of the regulation of advance directives under the law. These directives and related procedures are cumbersome and legalistic for patients and family members in a way that makes it difficult for them to fully understand the consequences and make informed decisions that align with their values [7,11].

ARTIFICIAL INTELLIGENCE-BASED TECHNOLOGIES HOLD GREAT PROMISE FOR IMPROVING IMPLEMENTATION OF ISRAEL'S DYING PATIENT ACT OF 2005 AND PROVIDING BETTER PALLIATIVE CARE THROUGH ACCURATE PREDICTIONS, PROGNOSES, AND TREATMENT OPTIMIZATION. HOWEVER, ETHICAL, SOCIETAL, AND LEGAL CHALLENGES MUST BE ADDRESSED.

ARTIFICIAL INTELLIGENCE

The emergence of AI-based technologies offers new opportunities in the medical field, including palliative care [12]. AI presents the potential to implement Israel's Dying Patient Act by improving the quality and accuracy of documentation in medical records as well as enabling predictive modeling for optimized care plans among palliative patients by providing advanced and personalized EOL care planning and improving clinical decision-making.

AI-based technologies can absorb a considerable amount of data (big data) and identify, process, analyze, and produce results that can be used effectively. Their achievements are not possible through human analysis and inference alone. Algorithmic analysis can offer suggestions for diagnosis, medical intervention, medical insights, and strategy, thereby improving treatment at various stages of disease diagnosis. AI-based technologies can help identify patients suitable for palliative care by analyzing medical records and predicting patient mortality, all of which help patients make informed decisions, plan personalized treatment, effectively manage symptoms, and avoid unnecessary treatments. AI-based technologies can also optimize palliative care by providing decision-support tools and help in planning care at the EOL [13,14].

One of the main advantages of AI-based technologies in palliative care is the ability to support clinical decision-making in real-time. By analyzing big data, AI-based technologies can provide personalized recommendations based on a patient's current condition and medical history while considering their wishes. The following sections will detail the possible contribution levels of using AI-based technologies in EOL care.

AI AS A TOOL FOR LIFE EXPECTANCY PREDICTION AND EOL PLANNING

Palliative care is an area of health that may be improved with AI-based technologies that recognize patterns and make predictions based on data. AI-based technologies can support clinical decision-making by predicting patient prognoses and estimating expected life expectancy. In fact, AI-based technologies can even predict the likelihood of disease progression, survival rates, and mortality. This powerful predictive tool can help medical professionals apply the law more successfully for dying patients [3].

AI-based technologies can process medical records and

more accurately identify cancer patients at high risk of mortality in a short time. These patients are identified as the most suitable for a conversation about EOL planning and their preferences [15]. The use of AI-based technologies as a predictive tool can be integrated into the clinical work environment to ensure that patients identified as having a high risk of mortality in a short time will have discussions and EOL planning while expressing their preferences and values. They will also be able to consider formulate advance directives and express their wishes regarding the medical treatment that will be given or withheld under some circumstances that the law recognizes.

IMPROVING THE QUALITY AND ACCURACY OF THE DOCUMENTATION IN MEDICAL RECORDS

As a tool for predicting life expectancy, AI can also improve the quality and accuracy of the documentation in medical records. Using AI-based technologies can also help reduce errors and improve the accuracy of medical records by providing real-time feedback to doctors. For example, AI algorithms can analyze patient data in real-time and alert doctors to potential errors or inconsistencies in the data, such as in conflicting lab results or drug interactions. This information can help ensure that medical records are complete and accurate, and that they support predictive accuracy [16].

PERSONALIZED TREATMENT AND SYMPTOM MANAGEMENT

Because AI-based technologies can create and capture data and focus on converting big data into intelligent data through personalized processing, patients, accompanied by the clinical team, can make better decisions and take timely actions in a personalized way. An example of the use of technology in this context is the ability to identify distress, pain, and severe symptoms in terminally ill patients by analyzing text data in medical records [12]. Hence, real-time detection can help the clinical team adjust the individual treatment, while being supported on the patient's wishes and values.

CHALLENGES IN AI-BASED TECHNOLOGIES

Despite the possible contribution of using AI-based technologies to predict and improve the quality of care and symptom management, there are several social and ethical challenges in applying technology in palliative care.

THERE ARE STILL PRACTICAL CHALLENGES IN IMPLEMENTING ISRAEL'S DYING PATIENT ACT OF 2005 FULLY, INCLUDING LACK OF HEALTHCARE PROVIDER FAMILIARITY AND DIFFICULTIES IN DETERMINING LIFE EXPECTANCY. ARTIFICIAL INTELLIGENCE-BASED TECHNOLOGIES COULD HELP OVERCOME SOME OF THESE ISSUES.

In general, these challenges can be divided into four areas. The first area is data privacy and security. AI-based technologies deal ensuring that sensitive information is not shared with unauthorized individuals or organizations and that appropriate security measures are in place to prevent data breaches. A study that examined the acceptance of AI-based technologies in the medical field found that one of the barriers to the acceptance of the technology concerns the privacy of patient information and autonomy, due to the risk of an information leak or improper use for which the information was given (violation of the principle of informed consent, violation of the principle of contiguity of purpose) [17].

The second area is AI *stupidity*. AI-based technologies may produce inappropriate or incorrect information. This situation can occur when the algorithm is not adequately trained or lacks data to support its predictions.

The third area involves inaccuracy in predictions or prognostics. AI models may be less accurate in predicting patient outcomes with complex or multidimensional illnesses. These inaccuracies may lead to inappropriate or harmful treatment decisions.

The last area is bias. Although AI has the potential to reduce discrimination resulting from human biases and social structures, the fear of discrimination due to the possibility of bias arises from the data used to train the systems, which may not be representative and may reflect existing discrimination. Moreover, AI models may perpetuate existing biases in healthcare, such as racial or socioeconomic disparities, if they are trained via data that are not representative of the population for which they have intended to be used [17-20].

Even if these challenges can be overcome through the improvement, accuracy, security, and training of the technology and the data fed into it, several challenges may make it difficult to implement and use the technology, mainly in matters of prohibited discrimination due to the bias of data used to train the system and liability issues deriving from a machine operating in an autonomous manner. While humans are usually responsible for their actions, in the case of AI, it is difficult to assign responsibility when actions result from a system that learns independently and makes decisions autonomously without human involvement [21]. In Israel, some laws limit the use of information that can be entered into the system, such as privacy protection laws, copyrights, and trade secrets. These limitations may lead to

databases that are not diverse and may be biased and give discriminatory results.

Regardless of these difficulties, social and ethical principles and considerations must guide the use of AI-based technologies. Technology must be transparent, fair, and responsible. In a document of principles published by the Ministry of Innovation, Science and Technology (2022) [18], five options were presented for imposing responsibility of the use of artificial intelligence systems on the developer of the system, on the operator of the system, on the human factor involved, on the artificial intelligence system as a separate legal entity, and on other parties such as the importer and distributor of the system.

FUTURE VISION

Using AI-based technologies in palliative care has great potential for applying the law in end-of-life situations. We expect an increased use of AI-based technologies, including predicting life expectancy, improving the quality of medical record documentation, managing symptoms, and adjusting personal care according to the needs and wishes of the patient.

CONCLUSIONS

Healthcare professionals must continue to implement AI-based technologies that can provide added and significant value in shaping a patient's last days according to the wishes and values while preserving important personal values, dignity, and privacy.

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Half the truth is often a great lie.
Benjamin Franklin (1706–1790), American statesmen, author, printer, satirist