Artificial Intelligence in Robotic Technology for Delivering Sustainable and Accountable Healthcare System in Indonesia Under International Law

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Abstract. Artificial Intelligence (AI) in medical realm has developed rapidly over the years. One of the prominent (AI) form of technology these days, is robot. Robotic technology are all over medical spots, both in clinics and hospitals. This paper analyzes whether or not robotic technology through AI's infusion in medical world has been implemented effectively and in a broader sense encompassing all societal elements in Indonesia. This research uses mixed such as sociological, medical and juridical method by analyzing as to how robotics technology has affected medical world both for doctors and patient in Indonesia. Thus, this paper also analyzes how Indonesian society, particularly medics, could finally embrace the future challenges concerning the emergence of this new sophisticated technology in line with the current national and international legal framework. This research shows although AI in robotics technology has shaped medical realm in a very sophisticated way, it still poses some significant threat to healthcare. Therefore it requires critical analysis and approach in minimizing its harmful impact. This effort is imperative so that AI in robotic technology can deliver sustainable and accountable healthcare framework and services effectively, particularly within Indonesian society under International Law.

Keywords: Artificial Intelligence, Robot, Healthcare, Indonesia, International Law

INTRODUCTION

Artificial Intelligence (AI) is a technological tool that can mimic intelligent behavior and critical thinking equivalent to humans. The purpose of AI is to automate activities that currently require human intelligence [1]. This artificial intelligence program can automatically improve algorithms through the use of machine learning. AI is also frequently used as a tool to solve and identify complex problems in various fields, including business, healthcare, corporations, and government [2]. The information and data provided by AI solutions can be utilized by both humans and other technologies.

In the healthcare world, AI is expected to have significant benefits for clinical practice. Researchers and companies in the healthcare sector worldwide have recognized and are delving deeper into the potential of AI technology for improving

the field of healthcare. It is not uncommon to see researchers racing to develop AI systems that may augment or even replace the role of doctors [3]. In this context, the understanding of disease biology and disease progression continues to advance. Currently, biomedical research and clinical practice face increasingly complex challenges, particularly related to the data generated by technology and questions about how to derive new diagnoses and therapies from this data [4]. It is crucial to gather, examine, and utilize experimental results, which are often hidden in clinical data warehouses. This will enable us to gain a more comprehensive and data-driven understanding of diseases, which in turn will facilitate better decision-making [5].

Essentially, it is unlikely that AI implementation will fully replace the role of doctors; however, it is very likely that AI will assume many roles and create new tasks in the medical care process. This is evidenced by robotics, which, often considered a subfield of artificial intelligence, is playing an increasingly important role in patient care. New AI-based technologies have been developed to predict disease recurrence and progression, or responses to treatment. In practice, artificial intelligence (AI) in medicine mimics the decision-making procedures of medical professionals [6]. Additionally, AI is responsible for generating data, while robotics can produce tangible results or perform physical tasks. The combination of these technologies allows for a variety of tasks to be accomplished, including diagnosis, surgical procedure planning, monitoring physical and mental health, and performing fundamental physical interventions to enhance patient independence during physical or mental decline. In the next section of this paper, we will discuss specific realizations that have occurred [7].

Indonesia, with its low doctor-to-population ratio, will benefit greatly from the potential of AI. AI-powered chatbots, integrated with data from multiple sources, can improve healthcare accessibility across the archipelago. The integration of AI with digital health platforms such as Halodoc has the potential to improve the quality of healthcare in Indonesia. However, the journey towards AI integration is not without its challenges.

The integration of AI and Healthcare robotics has marked a transformative era, offering unprecedented opportunities to improve patient care, streamline processes, and enhance the capabilities of medical professionals, particularly in Indonesia. This review article discusses the growing influence of AI robotics in healthcare, covering various applications, benefits, challenges, and future prospects. We study the role of AI robotics in medical diagnosis, surgical intervention, rehabilitation, patient monitoring, and drug discovery. In addition, we explore the ethical considerations, international regulatory frameworks, and societal implications shaping the adoption and advancement of AI Robotics in Healthcare. By bringing together current research and real-world implications, this review sheds light on the profound impact of AI Robotics, paving the way for a revolutionized healthcare landscape and regulatory framework under international law.

SUBJECT AND METHOD

In this study, systematic review methods are used with a qualitative approach and a mix of technical, sociological, and juridical normative approach. During this method, relevant research will be analysed by analyzing as to how robotics technology has affected medical world both for doctors and patient perticularly in Indonesia. Therefore it will be further analyzed as to how robotics technology has affected medical world both for doctors and patient in Indonesia. Furthermore, through the aforementioned research method, this research will analyze how Indonesian society, particularly medics, could finally embrace the future challenges concerning the emergence of this new sophisticated technology in line with the current national and international legal framework.

If there are no existing laws, then how can the existing law regarding the use of AI or robotic technology in the case of a medical science legal dispute be applied? In this context, from the sociological, legal, and cultural perspectives, researchers will collect data on problems, difficulties, conditions and behaviours in society, and the lawfulness of AI or robotic technology in order to have effective law enforcement within the medical field.

RESULTS

In the last decade, technological transformation has advanced significantly, enabling intelligent machines to perform tasks that are more comprehensive and extensive than ever before. This has also been the case in healthcare [8]. The activation of robotic surgical systems powered by AI has markedly altered traditional surgical procedures. Aimed at reducing surgical risks and improving patient outcomes, AI-driven robotic systems now offer advanced solutions for invasive and complex interventions. Their integration into telemedicine, particularly for remote patient monitoring, has demonstrated significant progress in healthcare services beyond traditional clinical settings [9]. Using devices such as telepresence robots, hospitals can remotely review patients, monitor vital signs, and provide timely interventions, especially in underserved or isolated areas [10]. The application of AI-powered robotic systems has increasingly supported individuals with mobility challenges or neurological disorders [11]. The implications of robotic exoskeletons, prosthetics, and rehabilitation robots include aiding motor function recovery, enhancing mobility, and promoting independent living. Additionally, AI robotics significantly impacts data analysis, healthcare analytics, and diagnostic imaging, aiding in disease detection through deductive modeling and care planning [12]. These systems also enhance diagnostic accuracy, streamline workflows, and optimize resource allocation [13]. As

AI-powered robotics continue to evolve in healthcare, it is crucial to address ethical issues related to patient privacy, algorithmic bias, and human-AI interface [14]. Furthermore, regulatory frameworks must adapt to ensure the safety, efficacy, and equitable access to AI-driven healthcare technologies [15].

Applications Indonesia

New technologies that develop and have a major influence on the needs of the times have implications for industries in Indonesia, especially in the health sector. Artificial intelligence (AI), automation and machine learning, hospitals, doctors, insurance companies and the healthcare industry are all impacted. Indeed, there are a number of potential uses of AI in medicine [16]. Currently, and in the future, there are at least seven common ways in which AI is changing the Healthcare sector:

1. Management of Medical Records and Other Data

As the first step in healthcare is the collection and analysis of information (such as medical records and other past history), data management is a frequently used application of artificial intelligence.

2.   Repetitive Work

Analyzing tests, CT scans, x-rays, data entry and other mundane tasks can be performed more accurately and faster by robots. Radiology and cardiology are two disciplines where the amount of data to be analyzed can be overwhelming and time-consuming. Cardiologists and radiologists of the future should only see the most complicated cases where human supervision is useful.

3.   Care Design

Human-centered design is about understanding human needs and how design can meet those needs. A humane approach and its systemic creativity with reference to the design process and the outcomes of that process, which include physical products, services, procedures, strategies, and policies. In this context, artificial intelligence systems have been created to attempt to analyze data such as vital records and reports from patient files, external research and clinical expertise that are useful for selecting the correct care pathway that matches the patient's needs.

4.   Digital Consultation

Digital consultation or telemedicine by the American Academy of Family Physicians is defined as the practice of using technology to provide health services remotely. This concept is done to make it easier for a doctor

and patient to communicate remotely. One of these medical consultations in the UK is an app like Babylon that uses AI to provide medical consultations based on personal medical history and general medical knowledge. Users report their symptoms into the app, which uses voice recognition to compare them with a database of diseases. Babylon then offers recommended actions, taking into account the user's medical history.

5.   Virtual Nurse

A digital nurse is available to monitor a patient's condition and follow up with treatment between doctor visits. The program uses machine learning to support patients, specializing in chronic diseases. In 2016, Boston Children's Hospital developed an app for Amazon Alexa that provides basic health information and advice for parents of sick children. The app answers questions about medications and whether symptoms warrant a doctor's visit.

6.   Medication Management

        In this case there is an application in the form of the AiCure Application to monitor the use of drugs by patients created by the National Institutes of Health. Smartphone webcams partner with AI to autonomously confirm that patients are taking their prescriptions and help them manage their conditions. Typical users of this app are people with serious medical conditions, patients who tend to go against doctors' advice, and participants in clinical trials.

7.   Drug Creation

Drug development is based on clinical trials that can take more than a decade and cost billions of dollars. Amidst the recent Ebola virus scare, an AI-powered program was used to scan existing drugs that could be redesigned to fight the disease. The program found two drugs that could reduce the effectiveness of Ebola very quickly. Which would normally take months or years but with the creation of the drugs with cutting-edge AI technology, the process of creating a potent cure within a day is a difference that could save thousands of lives.

. The aforementioned are some examples of solutions that AI provides to the healthcare industry. The potential is considerable for governments, technology companies and healthcare providers to invest and pilot AI-powered tools and solutions. As innovation drives the automation capabilities and digital workforce of providers, more solutions to save time, lower costs, and improve

accuracy will be possible. Here are 5 (five) AI advancements in healthcare that seem to have the most potential [17], namely; (1) AI-assisted robotic surgery; (2) virtual nursing assistants; (3) assisting clinical assessment or diagnosis; (4) workflow and administrative tasks; and (5) image analysis. This potential use of AI has a tremendous impact to be adopted by Indonesia as the country is looking for the most appropriate way in medicine to face the era of advanced technology.

AI Possible Legal Risks for Indonesia

The future of AI in the healthcare and legal sectors in many countries, including Indonesia, depends on various factors. These include technological advancements, the willingness of medical staff to become more skilled in technology and to test new products and approaches, customer expectations, the role of courts and other healthcare stakeholders, as well as the extent of regulatory measures and the suitability of the AI applications used [18]. To date, artificial intelligence has achieved limited but significant success across various disciplines, including biotechnology, medicine, chemistry, military science, and geology [19]. The characteristics and classification of AI risks can be found based on the severity of the potential harm and the likelihood and frequency of such harm [20].

New opportunities for artificial intelligence in healthcare are supported by the knowledge and understanding of medical personnel and the public about its use, especially in addressing the enormous medical and legal challenges and consequences, which can close the gap between medical personnel, legal aspirations, and the reality that currently plagues aspirations for justice [21]. The opportunities are immense, but of course trigger a risk that cannot be sorted out through over-regulation that could undermine the market in Indonesia and the region [22]. The benefits and risks posed by the use of technology have yet to be fully explored. However, there are at least 4 (four) legal issues related to AI and machine learning that may occur in the Indonesian healthcare system when the country actually adopts AI-based technologies, namely [23].

AI-Related Laws in Indonesia

Indonesia does not currently have a specific law on AI, however, AI-related systems are implicitly regulated in Article 1 paragraph (8) of the Electronic Information and Transaction Law (ITE Law) of 2016, which reads "Electronic Agent is an electronic device that is automatically used to perform an action on certain Electronic Information,

operated by a Person." In addition, there are a number of articles in the law that can serve as a legal basis for the risks that may arise due to the existence of AI. These include the 1945 Constitution of the Republic of Indonesia, the 1999 Consumer Protection Law, the 2009 Health Law, and the 2016 Electronic Information and Transactions Law.

These regulations provide a mandate for people to be able to defend their lives and existence from advanced technologies such as AI. The guarantee of people's lives as regulated by the 1945 Constitution is the legality given by the state in protecting and guaranteeing a decent life and from concerns with this significant technological development. On the other hand, the Law on AI regulates the privacy of citizens and the protection of personal data. The presence of these regulations is important to create legal compliance especially in healthcare to prevent future crimes or to find the best legal solution to the risks that may occur in the application of AI technology in medicine.

In the event of a violation that occurs as a result of making a mistake using AI, this is certainly when looking at Article 21 paragraph (1) & (2) of the ITE Law can be applied to refer to whom the error can be charged, the Article explains that the sender or recipient can carry out Electronic Transactions directly, or through his attorney, or through an Electronic Agent. In addition, the Party responsible for all legal consequences in the implementation of Electronic Transactions as intended is regulated as follows: a. if carried out directly, all legal consequences in the implementation of Electronic Transactions are the responsibility of the parties to the transaction; b. if carried out through a power of attorney, any legal consequences in the implementation of Electronic Transactions are the responsibility of the power of attorney; or c. if carried out through an Electronic Agent, any legal consequences in the implementation of Electronic Transactions are the responsibility of the Electronic Agent organizer." Therefore, the parties responsible for AI malpractice have been regulated by law.

Indonesia should Learnfrom Other Countries as a Solution

The presence of AI certainly has its own implications for a good country, AI itself can affect the acceleration of a country's development but besides that, its existence can widen the gap between developed and developing countries. The visible condition of developing countries is the uneven development of digital infrastructure and the availability of internet access networks. The projection of investment flows is more aimed at developing new technology for countries that already have qualified digital infrastructure. Developing countries are also not represented in forums related to AI development, even though there are great opportunities for the utilization of AI for the economic and social development of developing countries. However, the

existence of AI opens up opportunities for potential cooperation between countries. AI itself is borderless, so AI and its disruptive impacts need to be properly addressed on an international scale through cooperation between countries. International cooperation related to AI is needed in particular to establish norms for AI utilization at the international level, mitigation of digital risks at the regional and international levels, as well as cooperation in research, innovation, and technology transfer.

The development of AI needs to be taken seriously by the government, especially in health services. In fact, currently there are more legal questions than answers. Therefore, in such conditions Indonesia needs to be pro-active and ready to find out the answers to these questions to prove the fact that Indonesia is leading the ASEAN Region in adopting AI. Indonesia also needs to learn from countries that have experienced the use of AI by making a technology to facilitate and become a solution to the impossible. Therefore, Indonesia can take lessons from European countries as the European Parliament's Legal Affairs Committee approved a report asking the EU Commission to introduce a set of rules on robotics.

CONCLUSION

The use of AI is considered as a technology that has a significant impact on the work process of mankind, AI also provides its own opportunities and challenges that must be considered comprehensively. In Indonesia, the use of AI is useful in all fields including in the field of Health, such as use to manage medical records and other data, drug manufacturing, virtual, and medication management. In addition, AI tools offer AI-assisted robotic surgery; virtual nursing assistants; workflow and administrative tasks; assisting clinical assessment or diagnosis; and image analysis. However, there are great legal risks in developing AI that can occur at any time. Indonesia as a pluralistic country and a large country that is progressing. It should be able to respond well to the use of AI, especially to focus on strengthening laws related to AI. The response is to anticipate violations caused by the misuse of AI-based technology. Indonesia can also learn and see from other countries that have experience in adopting such advanced technology.

References

[1] Al-Emran M, Arpaci I. Intelligent systems and novel coronavirus (COVID-19): A bibliometric analysis, in Emerging Technologies During the Era of COVID-19 Pandemic. 2021:59–67. Available:https://doi.org/10.1007/978-3-030-67716-9_5

[2] Al-Emran M, Al-Maroof R,. Al Sharafi MA, Arpaci I. What impacts learning with wearables? An integrated theoretical model. Interact. Learn. Environ. 2020:1.21.Available:https://doi.org/10.1080/10494820.2020.175321

[3] Al-Emran M, V. Mezhuyev A. Kamaludin K. Shaalan, The impact of knowledge management processes on information systems: A systematic review. Int. J. Inf. Manag. 2018;43:173–187. Available:https://doi.org/10.1016/j.ijinfomgt. 2018.08.001

[4] Al-Emran M, Zaza S, Shaalan K. Parsing modern standard Arabic using Treebank resources, in 2015 International Conference on Information and Communication Technology Research, ICTRC; 2015. Available:https://doi.org/10.1109/ICTRC.20 15.7156426

[5] Andriella A, Alenyà G, Hernández-Farigola J, Torras C, Deciding the different robot roles for patient cognitive training; 2018.

[6] Bajones M, Fischinger D, Weiss A, Puente PDL, Wolf D, Vincze M, Körtner T, Weninger M, Papoutsakis K, Michel D, Qammaz A, Panteleris P, Foukarakis M, Adami I, Ioannidi D, Leonidis A, Antona M, Argyros AA, Mayer P, Panek P, Eftring H, Frennert S. Results of field trials with a mobile service robot for older adults in 16 private households. ACM Trans. Hum.-Robot Interact. 2020;9(2):1–27.

[7] Routhier F, Bouffard J, Dumouchel D, Faieta J, Pacciola D. Use and outcomes of a wheelchair-mounted robotic arm—preliminary results of perceptions of family. Neurorehabilitation Neural Repair 35(4), NP1–NP275;2021.Available:https://doi.org/10.1177/1545968320988381.

[8] Syed L, Jabeen S, Manimala S, Alsaeedi A. Smart healthcare framework for ambient assisted living using IoMT and big data analytics techniques. Future Gener. Comput. Syst. 2019;101:136151.Available:https://doi.org/10.1016/j.future.2019.06.004 Worldometer (n.d.), Available:https://www.worldometers.info/

[9] Yang G, Pang Z, Jamal Deen M, Dong M, Zhang YT, Lovell N, Rahmani AM. Homecare robotic systems for Healthcare 4.0: Visions and enabling technologies. IEEE J. Biomed. Health Inform. 2020;24 (9):2535–2549.

[10] Zlatintsi A, Dometios AC, Kardaris N, Rodomagoulakis I, Koutras P, Papageorgiou X, Maragos P, Tzafestas CS, Vartholomeos P, Hauer K, Werner C, Annicchiarico R, Lombardi MG, Adriano F,

[11] Asfour T, Sabatini AM, Laschi C, Cianchetti M, Güler A, Kokkinos I, Klein B, López R, I-Support: A robotic platform of an assistive bathing robot for the elderly population. Robot. Auton. Syst. 2020;126. Available:https://doi.org/10.1016/j.robot.2020.103451

[12] AlQudah AA, Al-Emran M, Shaalan K. Medical data integration using HL7 standards for patient's early identification. PLoS ONE. 2021;16.

[13] AlShamsi M, Al-Emran M, Shaalan K. A systematic review on blockchain adoption. Appl. Sci. 2022:12

[14] Do HM, et al. RiSH: A robot-integrated smart home for elderly care. Robot. Auton. Syst. 2018;101.

[15] Fernandes T, Oliveira E. Understanding consumers' acceptance of automated technologies in service encounters: Drivers of digital voice assistants adoption. J. Bus. Res. 2021;122

[16] Novatio, 2019, "10 Common Applications of Artificial Intelligence in Health Care", taken from https://novatiosolutions.com/10-common-applications-artificial-intelligence-healthcare/.

[17] Forbes, 2022, "How is AI Used in Healthcare -5 Powerful Real-World Examples that Show the Latest Advances", taken from https://www.forbes.com/sites/bernardmarr/2018/07/27/how-is-ai-used-in-healthcare-5-powerful-real-world-examples-that-show-the-latest-advances/#75f4b7a5dfbe,

[18] Goodman, Chris Chambers, 2019, "Symposium: Lawyering in the Age of Artificial Intelligence", Oklahoma Law Review, Autumn 2019, 72 Okla. L. Rev. 149.

[19] Spagnoletti, Robert J., 1987, "Using ArtificialIntelligence to Aid in the Resolution of Socioscientific Disputes: A Theory for the Next Generation", Journal of Law & Technology, Winter 1987, 2 J.L. & Tech. 101

[20] European Parliamentary Research Service, 2022, Artificial Intelligence in Healthcare: Applications, Risks, and Ethical and Societal Impacts, Brussels, European Union, ISBN: 978-92-846-9456-3, doi:10.2861/568473

[21] Cuéllar, Mariano-Florentino, 2017, "Symposium--Future-Proofing Law: from Rdna to Robots", U.C. Davis Law Review, November 2017, 51 U.C. Davis L. Rev. 27.

[22] Coraggio, Giulio, 2017, "Are you ready for Artificial Intelligence?", Cyberspace Lawyer, April 2017, 22 No. 3 Cyberspace Lawyer NL 1

[23] Traverse Legal, 2017, "Top 5 Legal Issues Inherent in AI and Machine Learning", taken from https://www.traverselegal.com/blog/top-5-legal-issues-inherent-in-ai-and-machine-learning/