

Analysis of artificial intelligence errors in practical medicine and rehabilitation

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ABSTRACT

Aim: To structure the types of errors that occur when using artificial intelligence in healthcare, as well as assess their impact on the accuracy of diagnostics and therapeutic decisions. Identify ways to minimize errors and increase the effectiveness of the use of AI in practical healthcare and rehabilitation.

Materials and Methods: Publications published from January 2021 until December 2025 were processed and analyzed according to the keywords of the topic of work "Pathology", "research on the results of diagnostics and treatment", "artificial intelligence", "machine learning", "deep learning", "federated learning", "use of AI in rehabilitation", "structuring of AI errors" in the databases of PubMed, MEDLINE, Web of Science. Articles were selected based on the presence of: quantifiable results and usage of AI as the main or secondary evaluation method. A total 57 articles were reviewed, out of which 38 were excluded based on eligibility criteria and 2 were excluded as duplicates.

Conclusions: Artificial intelligence is becoming an integral part of modern medical diagnostics and therapeutic solutions. Its implementation significantly increases the accuracy of diagnostic processes and allows for personalized treatment, but today there is no universal solution for the practical use of AI. A lot of errors are still recorded when using AI in diagnostic and prognostic processes, ethical issues have not been resolved, integration of all molecular information available to the patient is not always ensured, there are no uniform standards for collecting and processing medical data, a unified medical language, etc. To ensure professional machine learning, widespread implementation of an open healthcare system, balanced and unified guiding principles is necessary. The implementation of AI technologies depends on the training of doctors and the availability of technologies.

KEY WORDS: Pathology, artificial intelligence, use of AI in rehabilitation, structuring of AI errors

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INTRODUCTION

Artificial intelligence (AI) is becoming increasingly prevalent in healthcare. There is ample evidence of the potential of AI in the diagnosis, treatment, and management of patients. However, with its widespread use, numerous errors arise that can have serious consequences for patients. More and more AI tools are being implemented in clinical practice in histopathology and other areas of medicine. The application of AI in oncology includes the use of machine learning and deep learning algorithms that are able to analyze huge data sets and provide predictions and recommendations for patient treatment. Modern artificial intelligence models provide diagnostic accuracy ranging from 85% to 91% depending on the type of illness and the data being processed. In the case of melanoma for instance, one study by Andre Esteva et al showed a diagnostic accuracy of 91%, which is equal or higher than the diagnostic accuracy of experienced dermatologists [1]. In the case of lung and breast cancer diagnostic accuracy was in the range of 87-89% when using AI [2].

Histopathology, along with other imaging-based diagnostic specialties such as radiology, has seen significant development in AI tools. From a diagnostic perspective, AI can improve the accuracy and efficiency of diagnostics. However, AI tools and the machine learning (ML) algorithms on which they are based are not foolproof, and achieving perfect accuracy is unlikely. Therefore, the implementation of AI will bring not only the above-mentioned benefits, but also the general problem of errors in AI tools [3].

Artificial intelligence is revolutionizing rehabilitation, enabling personalized and effective data-driven patient care. AI analyzes patterns, predicts outcomes, and tailors treatments to individual needs, allowing doctors to provide more targeted and timely care [4].

AI is also used to process unstructured medical data, such as text-based patient reports and electronic medical records (EMR), which can increase decision-making accuracy by up to 90% in complex clinical cases [5]. In telemedicine systems that use large language models (LLM), diagnostic accuracy is also improved through

efficient processing of patient text data. Thus, the use of such tools will bring a number of benefits to diagnostic specialties - increased diagnostic accuracy and efficiency in particular.

However, despite significant advances, AI faces a number of challenges and its use will inevitably lead to new errors occurring, thus achieving perfect accuracy is unlikely [6]. A report by the European Parliamentary Research Service identified harm to patients caused by AI errors as one of the main risks arising from the introduction of AI in healthcare [7].

One of the main concerns is bias in the data which the models use for training, which can lead to incorrect diagnoses or treatment recommendations. In addition, there are ethical issues related to the confidentiality of patients' medical data and the transparency of AI algorithms. These errors made by AI tools are essentially misclassifications made by a computational algorithm. There is often no understanding of how these errors affect patients' clinical outcomes, which means that data on the safety of AI tools is incomplete. But in reality, the problem is much more complex.

AIM

To structure the types of errors that occur when using artificial intelligence in healthcare, as well as assess their impact on the accuracy of diagnostics and therapeutic decisions. Identify ways to minimize errors and increase the effectiveness of the use of AI in practical healthcare and rehabilitation.

MATERIALS AND METHODS

Publications published from January 2021 until December 2025 were processed and analyzed according to the keywords of the topic of work "Pathology", "research on the results of diagnostics and treatment", "artificial intelligence", "machine learning", "deep learning", "federated learning", "use of AI in rehabilitation", "structuring of AI errors" in the databases of PubMed, MEDLINE, Web of Science. Articles were selected based on the presence of: quantifiable results and usage of AI as the main or secondary evaluation method. A total 57 articles were reviewed, out of which 38 were excluded based on eligibility criteria and 2 were excluded as duplicates.

ETHICS

All sources used for review are publicly available.

REVIEW AND DISCUSSION

First, let's define what diagnostic errors are. According to the WHO definition, "A diagnostic error emerges

when a diagnosis is missed, inappropriately delayed or is wrong. Diagnoses can be completely missed (cancer missed despite symptoms), wrong (patients told they have one diagnosis when there is evidence of another) or delayed (abnormal test result suggestive of cancer, but no one has told the patient). There may be overlaps in these classifications. Diagnoses often occur over time, rather than at one point in time, including initial assessment, performing and interpreting diagnostic tests, follow-up and tracking" [8].

It is important to emphasize that, despite the importance of such a definition, it does not fully correspond to the problems of our study. Indeed, the greatest difficulties are the inability to substantiate and identify the degree of detail of the diagnosis in specific clinical cases. The effectiveness of AI may be sufficient with a lack of pathologic details, but each new step can be catastrophic. It should also be noted that studies assessing the effectiveness of AI in clinical practice are limited by retrospective designs and sample sizes. Such designs potentially include characteristics of dispersion, spectrum shift, and other confounders. In other words, models are developed according to a specific data set. In practice, they are not repeated in other data sets. At the same time, comparing artificial intelligence with doctors, although well represented in the scientific literature, is probably not the best way to address the issue of differing effectiveness. Moreover, some studies now approach the interaction of doctors and algorithms as a combination of human and artificial intelligence, and the possible comparison of diagnoses when monitoring the pathological process is especially important. But this is practically impossible in emergency medicine, and it is extremely difficult to determine the thresholds for decision-making.

Errors in image recognition (diagnosis, patient assessment) are one of the most common types of errors of artificial intelligence in medicine. In particular, machine learning algorithms, such as deep learning, are used to analyze medical images in various fields, including oncology. For example, a systematic review done by Alina Cornelia Pacurari et al found that the accuracy of AI for diagnosing lung cancer ranged from 77.8% to 100%, with sensitivity (which is known to measure the ability of a test to correctly identify patients with the disease) ranging from 0.81 to 0.99. Despite this, specificity (the test's ability to correctly identify healthy patients who do not have the disease) ranged from 0.46 to 1.00, indicating the possibility of significant false-positive results in some cases. Despite high sensitivity rates, specificity remains problematic and requires further research [9]. However, the use of AI in medicine does not always produce such conclusions. For example,

artificial intelligence is increasingly used in oncology for medical image analysis, biomarker assessment, molecular profiling, and treatment outcome prediction. AI errors are recorded along with correct conclusions and this can affect clinical decisions. For example, some studies show that despite significant advances in AI in personalizing treatment, oncological processes remain extremely heterogeneous. This complicates the work of AI due to the variability of clinical data and the complexity of the molecular characteristics of tumors [10].

So, the question we must ask is – if artificial intelligence and machine learning algorithms can be reduced to clinically useful “apps”, will they be able to break through mountains of clinical, genomic, metabolomic, and environmental data to aid in accurate diagnosis? On the one hand, the implementation of multiomic approaches that combine various biomedical data (genetic, proteomic, metabolomic) allows for increased prediction accuracy and more personalized treatment recommendations. Quantitative indicators from a number of studies demonstrate that when molecular profiling is used, the accuracy of therapeutic decision-making increases by 15-20%. On the other hand, it remains a challenge for AI to fully integrate this data due to its variability and complexity. The choice of the wrong treatment is often related to the complexity of the molecular characteristics of tumors and individual patient responses. The aforementioned study showed that AI sometimes cannot correctly differentiate different types of cancer cells due to the complexity of the histological and molecular characteristics of tumors. The accuracy of such systems can reach 87-89%, but in cases with complex tumor heterogeneity this indicator may decrease [10].

Further evidence that AI does not always integrate all available molecular information to make therapeutic decisions was established in a study by Yousaku Ozaki et al [11]. It was found that a multiomic approach (genetic, proteomic, and metabolic data) can increase the accuracy of treatment predictions by 12%. This demonstrates the importance of developing algorithms that take into account different types of data to improve treatment outcomes.

Artificial intelligence is widely used to analyze medical images such as computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET). For example, research done by Diego Ardila et al showed that using AI achieves an accuracy of 77.8% to 100% in diagnosing lung cancer with a sensitivity of 0.81 to 0.99 and a specificity of 0.46 to 1.00 [12].

In the field of breast cancer diagnosis, one study showed that artificial intelligence improves diagnostic accuracy by 5-15% when using dual assessment of

mammograms. However, up to 30% of breast cancers may be missed due to thick parenchyma or interpretation errors [13]. The aforementioned systematic review by Alina Cornelia Pacurari et al demonstrated that using artificial intelligence to analyze mammograms improved diagnostic accuracy by 5-15%, reducing the number of false negatives to 2% compared to traditional methods. The algorithms also decrease false positives, reducing unnecessary biopsies by 5% [9]. Scott Mayer McKinney et al Research highlights that the accuracy of breast cancer diagnosis using AI reaches 94.6%, which exceeds the performance of radiologists by 6-7% [14].

The study by Diego Ardila et al also showed that deep learning algorithms can detect lung cancer with 94.4% accuracy, especially in the early stages of the disease. This significantly improves the possibility of early diagnosis, which is critical for successful treatment. The use of AI helps reduce the number of false positives by 12% [12]. At the same time, the question of quantitative assessment of the severity of the pathological process remains unclear. Almost the same applies to the article by Jasper Twilt et al, where the authors characterize the accuracy of prostate cancer diagnosis using MRI and AI algorithms as reaching 90%, which is 10-15% higher than traditional methods. This significantly reduces the number of false-positive results and increases the efficiency of biopsies [15].

The question of using AI in the early stages of a disease is extremely important. But we cannot answer this question without establishing a normal baseline. This simple question shows one of the weaknesses of the use of artificial intelligence and machine learning in medicine in the form in which it is widely used today.

Disease prediction is an important application of AI, with the potential to enhance our ability to predict the spread of infectious diseases and subsequently inform and guide public health interventions. It is an essential component of public health because it allows experts to prevent outbreaks and act quickly if they do occur. Considering that mathematical methods for diagnosing and predicting specific outcomes as a direct result of medical interventions are available, one should have expected some success in using AI. However, it has been shown that AI can provide inaccurate predictions of patient treatment efficacy, particularly in radiotherapy and chemotherapy. Just by integrating multiomic data, such as genetic and proteomic profiles of tumors, the accuracy of predicting treatment responses can be increased by 15–20% [5]. However, the complexity of mutational variability in tumors still poses challenges for AI in determining the most effective treatment strategies. With technological development, artificial intelligence algorithms have shown significant improvements in

the accuracy of predictions and diagnostic decisions. For instance, it was demonstrated that the accuracy of predicting the response to radiotherapy using AI increased to 90%, which significantly exceeds the accuracy of traditional methods (65-75%). The integration of multiomic data allowed to increase the efficiency of treatment prediction and take into account the genetic and molecular profiles of tumors [5].

AI is also being actively used to provide treatment recommendations where treatment decisions are complex and require personalization. For example, in the study by William Lotter et al, AI was used to individualize therapy based on the molecular characteristics of tumors [10]. However, the technology still needs to be improved, as some treatment recommendations do not take into account specific patient characteristics, which can lead to erroneous decisions. These difficulties can be overcome in the era of accessible healthcare, which is slowly being implemented in various countries today.

Let us now focus on the results of using AI in rehabilitation. The work by Seyyedeh Fatemeh Mousavi Baigi et al summarizes the opinions of university teachers and students. Most teachers considered the main problem to be the inability to make decisions in unforeseen circumstances that go beyond their planning (57.1%) [16]. Lack of practical knowledge was cited as a barrier to implementing AI in rehabilitation among students and faculty. In addition, the most common barriers noted by experts and students were the cost and availability of AI resources in rehabilitation. Another study noted that while AI has many advantages in predicting patient diagnosis and prognosis, there is no clear evidence on the current understanding of physiotherapists' views and willingness to use AI in their practice, raising the question of the need for further research. Nevertheless, some respondents support the positive impact of AI-enabled applications on rehabilitation management [17].

In clinical setting, practical application is an important factor in increasing the interest of therapists and physicians in learning about AI and its implementation in clinical practice. Only 5% of the total sample reported practical usage of AI applications at work [18]. This is consistent with other studies that have shown that less than 10% of surgeons currently use robotic surgical techniques in hospitals, and 60% of surgeons documented the absence of AI and robotic technologies in their clinical practice [19]. These results emphasize the need to accelerate the implementation and adoption of AI through training courses and seminars among physical therapists.

Finally, research by Francesco Lanotte et al highlights that there are still challenges, especially regarding data privacy, physician training, and technology availability,

that could hinder the widespread adoption of AI in rehabilitation settings [18]. Ethical considerations regarding fairness, transparency, and security of AI-based systems must also be considered to ensure appropriate integration of these technologies into clinical practice. Efforts to reduce risks, ensure patient safety, and promote ethical use of AI will be crucial for the further development of these technologies.

Looking ahead, artificial intelligence opens up enormous opportunities for the rehabilitation development. Innovative approaches such as multimodal rehabilitation, AI-based virtual therapeutic aids, and advanced predictive analytics are designed to increase the accuracy of treatment and increase the accessibility of services, especially in regions with insufficient levels of health care. By continuing to explore and overcome existing barriers, we can open new horizons in rehabilitation, which will lead to more effective, patient-centered interventions and improved long-term outcomes.

In this regard, the implementation of AI in rehabilitation has the potential to change the landscape of patient care. With careful consideration of the challenges and ethical aspects, AI can play a key role in improving rehabilitation practices, providing patients with the best possible care tailored to their unique needs.

To increase the results of AI in oncology, it is recommended to improve and integrate multiomic models, which, according to previously mentioned study by Yousaku Ozaki et al, can increase the accuracy of therapeutic predictions by up to 12% [11]. The important implementation of a single medical language (such as UMLS), uniform standards for collecting and processing medical data is a key step to improve the accuracy of AI results [20]. Research highlights the need to improve the infrastructure for AI (medical institutions should invest in infrastructure to fully integrate AI with electronic health records (EHR), which will help improve the quality of diagnosis and treatment). At the same time, lack of consistency of data from different medical institutions makes it difficult to standardize results and implement unified approaches to treatment using with AI assistance.

A separate issue is the need for guidelines. They are needed to support and standardize this process, but as noted in an article by Axel Wismüller and Larry Stockmaster, there is currently no guidance on "objective evaluation of AI systems for clinically relevant performance measures" [21]. There are only a few guides specifically designed for AI to evaluate different types of studies, including CONSORT-AI (Consolidated Standards of Reporting Trials – Artificial Intelligence) for randomized controlled trials, SPIRIT-AI (Standard Protocol Items: Recommendations for Interventional

Trials – Artificial Intelligence) Diagnostic Accuracy Study for studies of diagnostic tests [22]. These guidelines provide checklists of minimal requirements to be included in reports of AI interventions and indicate that researchers should analyze error cases. However, there is currently no indication that this includes clinical error assessment, although this would be an ideal place to introduce such requirements and could be included in future versions.

Other important concerns about AI in healthcare include ethical issues and data privacy. A study conducted under the auspices of the National Academy of Medicine notes that patient data protection can be compromised due to errors in algorithms or due to cyberattacks. In addition, bias in training data can lead to inconsistency in diagnosis and treatment of patients of different demographic groups [20]. Clear ethical norms and standards need to be established to protect the privacy of patient data and reduce potential biases in AI algorithms and issues of fairness in access to technology.

Ensuring data standardization remains an important issue. Available research indicates that the lack of uniform standards for collecting and processing medical data is a major obstacle to the accurate and effective use of AI [9]. Inconsistency of data formats across medical institutions complicates the integration of AI into clinical practice. Improving the infrastructure for implementing AI in healthcare settings, particularly through interoperability of EHR, is essential to ensure more accurate diagnostic decisions and personalized treatment. Investments in this area will help avoid technical difficulties and increase the efficiency of healthcare. To improve diagnostic quality, it is necessary to develop common standards for medical systems,

which will reduce the number of errors and provide more accurate results. In addition, the integration of AI with a single electronic health system remains technologically difficult due to the lack of unified data transfer protocols. This makes it difficult to ensure the accuracy of diagnostic predictions and the effectiveness of therapeutic decisions.

Thus, further development of artificial intelligence in oncology and other medical fields should focus on improving algorithms, standardizing and classifying data, and addressing ethical challenges to ensure maximum benefit for patients and physicians.

CONCLUSIONS

1. Artificial intelligence is becoming an integral part of modern medical diagnostics and therapeutic solutions. Its implementation significantly increases the accuracy of diagnostic processes and allows for personalized treatment, but today there is no universal solution for the practical use of AI. A lot of errors are still recorded when using AI in diagnostic and prognostic processes, ethical issues have not been resolved, integration of all molecular information available to the patient is not always ensured, there are no uniform standards for collecting and processing medical data, a unified medical language, etc.
2. To ensure professional machine learning, widespread implementation of an open healthcare system, balanced and unified guiding principles is necessary.
3. The implementation of AI technologies depends on the training of doctors and the availability of technologies.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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