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THE ROLE OF ARTIFICIAL INTELLIGENCE IN MODERN CLINICAL PHARMACOLOGY AND DRUG DEVELOPMENT

We live in a technological world that annually generates huge amounts of data in every industry, aiming to communicate it to the final consumer. Clinical pharmacology is a scientific discipline that covers all aspects of the interactions between drugs and humans (Council for International Organizations of Medical Sciences, 2017).

Artificial Intelligence (AI) is a transformative technology used in various industrial sectors, including healthcare. AI has achieved great success in recent years, especially in machine learning and deep learning. Machine learning (ML) is an artificial intelligence approach that uses advanced statistical methods to enable computers to learn from data without explicit programming, allowing them to detect patterns and predict outcomes in complex healthcare scenarios. The most common learning styles used in healthcare include supervised, unsupervised, and deep learning (DL). There are other ML methods, such as semi-supervised learning and reinforcement learning, in which the algorithm acts as an agent in an interactive environment that learns through trial and error, using rewards for its own actions and experience (Graham et al., 2019).

Drug development has always been challenging, but the gap between investment and production is widening. Pharmaceutical companies face lower returns on research and development, longer timelines, and increased pressure to introduce targeted therapies more quickly.

Artificial intelligence offers a way to reverse this trend. It helps teams process data faster, reduce reliance on trial-and-error, and identify better drug candidates earlier in development. This is especially useful in early-stage research and clinical trial development – two areas where delays are common and costly.

In pharmaceutical practice, AI has the potential to improve medication therapy and patient care significantly. Using its algorithms and machine learning, pharmacists can analyze large amounts of patient data, including medical records, laboratory results, and drug profiles, helping to identify potential drug interactions, assess the safety and efficacy of medications, and provide informed recommendations tailored to the individual patient's needs (Chalasani et al., 2023).

Artificial intelligence has become a revolutionary tool for optimizing pharmacist practice, significantly improving drug prescribing, and supporting the growing field of precision medicine. However, regulatory considerations, data privacy, and ethical implications must be carefully considered when implementing it in healthcare (Kleebayoon & Wiwanitkit, 2024).

For patients, AI can be a useful tool for providing recommendations on when and how to take medications, facilitating patient education, and promoting adherence to medication regimens. It can also help patients understand how and where to receive effective medical care, improve communication with healthcare professionals, optimize health monitoring through wearable devices, provide daily lifestyle recommendations, and support diet and exercise planning.

The introduction of AI into modern clinics' activities has significantly increased the accuracy of selecting drugs for patient treatment regimens. This practice is especially important when patients change the type of medical care, such as transitioning from outpatient to hospital care, or when treatment regimens are revised. A reduction in the time required for coordinating pharmacotherapy has also been observed, decreasing the administrative burden on medical staff and allowing healthcare professionals to focus on more critical aspects of patient care (Chalasani et al., 2023).

Despite significant advances in the practical use of AI, challenges remain, particularly related to data quality, validation, trust, and regulatory issues. It is important to assess the real clinical impact of AI models to improve patient care. To fully realize

its potential, a collaborative approach is needed in which AI complements rather than replaces the roles of clinicians and pharmacists (Intensive Care Medicine, 2024).

The integration of AI into clinical pharmacology also raises significant ethical and safety considerations. The risk of dual use, particularly in the development of harmful biological applications, requires clear regulation and the adoption of strategic approaches based on transparency, accountability, and security principles (Rubinic et al., 2023).

AI is an important tool for organizing clinical drug trials, enabling more accurate predictions from the design stage through execution. It provides real-time recommendations on drug dosing, taking into account pharmacogenetic risks and drug interactions, and helps predict therapeutic effects and adverse reactions, and also improves clinical decision-making and patient safety, provided that healthcare professionals critically evaluate the data obtained.

When implementing AI in healthcare and education, regulatory requirements, data privacy, and ethical considerations must be carefully addressed.

AI opens up new opportunities for the pharmaceutical industry. Its use significantly accelerates drug development, increases the efficiency of clinical trials, and optimizes manufacturing processes. In the future, its role in pharmacy will continue to grow, contributing to the development of personalized medicine and improving the quality of healthcare worldwide.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON MODERN BUSINESS

Artificial intelligence (AI) has become one of the most transformative technologies of the 21st century, significantly influencing various sectors of the global economy. Modern business environments are rapidly evolving as AI-based systems integrate, enhancing decision-making, automating routine tasks, and improving overall efficiency. According to S. Russell and P. Norvig (2021), artificial intelligence is the study and development of systems capable of performing tasks that normally require human intelligence, such as learning, reasoning, and problem-solving.

One of the key impacts of AI on modern business is automation. Many companies use AI-powered tools to automate repetitive processes such as data entry, customer service, document processing, and inventory management. It allows organizations to reduce operational costs, minimize human error, and significantly increase productivity. For example, chatbots and virtual assistants are widely used in customer support systems, providing fast and accurate responses to clients' requests at any time of the day (Brynjolfsson & McAfee, 2017). In addition, robotic process automation (RPA) is increasingly applied in the finance and logistics industries to handle structured tasks without human intervention.