

AI and Antibiotics: Navigating a Complex Intersection



The integration of artificial intelligence into healthcare decision-making is transforming various aspects of clinical practice, including antibiotic prescribing. AI-powered tools, particularly large language models (LLMs), offer the potential to enhance antimicrobial stewardship by providing clinicians with real-time, context-aware recommendations. The dual objectives of optimising patient outcomes and reducing antimicrobial resistance make antibiotic prescribing a complex process, and AI has the capacity to streamline this by rapidly processing extensive medical datasets and offering tailored treatment suggestions. However, the implementation of AI tools in clinical practice is fraught with challenges, including issues related to accuracy, explainability and the potential for errors. Understanding these complexities is crucial to leveraging AI effectively in antibiotic prescribing while mitigating risks associated with its application.

Comparing AI in Scientific Writing and Antibiotic Prescribing

AI tools have already demonstrated their utility in scientific writing by improving efficiency and content generation. In such contexts, AI-generated content can be reviewed and revised without immediate consequences. However, the use of AI for antibiotic prescribing presents a distinct set of challenges. Unlike writing, where errors can be corrected before publication, prescribing antibiotics involves real-time clinical decisions with direct patient impact.

Inaccurate AI-generated recommendations could lead to suboptimal treatments, worsening patient outcomes and potentially contributing to antimicrobial resistance, which remains a pressing global health concern. Moreover, while AI can support medical professionals by synthesising large volumes of research and offering contextualised suggestions, it does not replace clinical reasoning. The probabilistic nature of LLM-generated outputs further complicates their use in high-risk clinical settings, necessitating human oversight to ensure safe application. Despite AI's potential to enhance prescribing accuracy, its limitations highlight the need for cautious integration into medical workflows.

The Risk of Error in AI-Assisted Prescribing

One of the primary concerns with AI-driven decision support systems is the risk of error. LLMs operate by predicting the most probable sequence of words based on training data, which means they can generate plausible but incorrect medical recommendations. Additionally, these models are prone to hallucinations—instances where AI generates misleading or entirely fabricated information. Unlike human clinicians who apply experiential judgement, AI lacks true contextual understanding, making the risk of error an evolving challenge. These errors may not always be obvious to the clinician using the AI system, particularly if the recommendations appear logically structured. A further complication is the variable quality of training data, as inconsistencies or biases in AI models can lead to flawed suggestions.

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While advancements in retrieval-augmented generation and continuous training on validated datasets may improve accuracy, these solutions do not eliminate the inherent variability of AI-generated outputs. Additionally, it remains unclear whether AI-based prescribing tools can effectively differentiate between borderline cases where empirical treatment is necessary and cases where additional diagnostic testing would be the safer course of action. This highlights the importance of ongoing research and rigorous testing before AI tools can be relied upon for high-stakes decision-making.

The Expertise Paradox in AI Implementation

AI tools in antibiotic prescribing raise an intriguing paradox: they are most beneficial for less-experienced clinicians who may lack the depth of expertise to critically assess AI recommendations. While AI can provide valuable guidance in complex cases, it also demands that users possess

sufficient clinical knowledge to recognise potential errors. This paradox creates a dual challenge—ensuring that AI tools support clinical decision-making without fostering overreliance, while also providing training that enables healthcare professionals to use AI effectively. If junior clinicians become too dependent on AI-generated suggestions, they risk losing the ability to develop independent critical thinking skills necessary for sound clinical judgement. Conversely, expert clinicians who can evaluate AI outputs may find AI's suggestions redundant, limiting its usefulness in certain settings.

Additionally, the variability of AI-generated recommendations can be influenced by how well clinicians formulate their queries—an aspect that is not always intuitive. Finding a balance between leveraging its capabilities and maintaining human oversight is essential for safe integration into antibiotic prescribing. Institutions must, therefore, ensure that clinicians receive proper training in AI literacy to maximise the benefits of these tools while minimising risks.

The use of AI in antibiotic prescribing offers significant opportunities to improve patient outcomes and support antimicrobial stewardship. AI-driven tools can rapidly process large volumes of data, providing contextually relevant suggestions that complement clinical expertise. However, their implementation requires careful consideration of accuracy, error risks and the level of clinician oversight. The expertise paradox further complicates AI's role in clinical decision-making, highlighting the need for structured training programmes that enhance AI literacy among healthcare professionals. Additionally, mitigating the risks associated with AI-generated errors requires ongoing refinement of models and improved methods for evaluating AI outputs in real-world settings.

AI in antibiotic prescribing must be approached with a balance of innovation and caution, ensuring that it complements rather than replaces clinical judgment. By addressing these challenges, AI can serve as a valuable tool in optimising antibiotic use while safeguarding patient safety and public health. The path ahead involves integrating AI into clinical practice through rigorous evaluation, ensuring that its benefits are realised without compromising care quality or patient safety.

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