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AI in Pharmacoeconomic Evaluation: Opportunity or Risk for Hospital Pharmacists?

Nagwa Ibrahim

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***Abstract*—** Artificial intelligence (AI) is increasingly transforming healthcare decision-making, including pharmacoeconomic evaluation and health technology assessment. AI-driven tools can automate data extraction, improve predictive modeling, enhance cost-effectiveness analyses, and support resource allocation decisions. For hospital pharmacists, these developments offer substantial opportunities to improve efficiency and evidence generation. However, concerns remain regarding algorithmic bias, transparency, data quality, reproducibility, and regulatory oversight. This review examines the emerging role of AI in pharmacoeconomic evaluation and discusses its implications for hospital pharmacists. While AI has significant potential to strengthen economic evaluations and optimize healthcare spending, human oversight remains essential to ensure methodological rigor, ethical integrity, and patient-centered decision-making.

Keywords: *AI*, Affordability, Healthcare System, Effectiveness, Pharmacoeconomic, PE evaluation.

1. INTRODUCTION

Pharmacoeconomic evaluation is a cornerstone of evidence-based formulary management, reimbursement decisions, and healthcare resource allocation. Hospital pharmacists are increasingly involved in cost-effectiveness analyses (CEA), cost-utility analyses (CUA), budget impact analyses (BIA), and health technology assessments (HTA) to support rational medicine use and healthcare sustainability (1,2). The rapid expansion of electronic health records claims databases, and real-world evidence sources has created unprecedented opportunities for applying AI techniques to health economic research and decision-making (3,4). AI encompasses machine learning, deep learning, natural language processing, and generative AI technologies capable of analyzing large, complex healthcare datasets beyond the capacity of traditional statistical methods (5,6).

[1] Global Healthcare Activities SRL, Cluj-Napoca, Romania.
***Corresponding Author:** Nagwa Ibrahim, PharmD, PhD
Email address: nag_ibrahim@hotmail.com
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Recent studies suggest that AI can improve the efficiency of evidence generation, facilitate more accurate predictions of clinical and economic outcomes, and enhance healthcare resource allocation (7,8). As healthcare systems face increasing financial pressures, AI-assisted pharmacoeconomic evaluation is attracting growing interest among policymakers, health economists, and hospital pharmacists (9).

2. Opportunities for Hospital Pharmacists

One of the most promising applications of AI in pharmacoeconomic is the automation of evidence generation. Machine learning algorithms can rapidly identify, screen, and extract relevant information from thousands of publications, substantially reducing the time required for systematic reviews and HTA processes (5,10). Natural language processing tools have also demonstrated utility in extracting clinical and economic outcomes from unstructured healthcare records, improving the efficiency of evidence synthesis and outcomes research (6,11).

Generative AI technologies are increasingly being explored for literature summarization, model construction, scenario analysis, and economic report preparation (12). These tools may support pharmacists by accelerating pharmacoeconomic workflows while maintaining methodological consistency. Although human validation remains essential, AI-assisted approaches have the potential to reduce administrative burdens and allow pharmacists to focus on higher-level clinical and strategic decisions (12,13).

AI can further strengthen predictive analytics by integrating demographic, clinical, genomic, and utilization data to estimate disease progression, treatment response, adverse drug events, and healthcare costs (8,14). Machine learning models often outperform traditional regression-based approaches when analysing complex, nonlinear relationships among healthcare variables (15). Improved prediction accuracy may enhance the quality of cost-effectiveness and budget impact models used in hospital formulary decision-making.

Several systematic reviews have reported favourable economic outcomes associated with AI-based healthcare interventions. Most published evaluations have found AI applications to be either cost-effective or cost-saving, primarily through improved diagnostic

performance, reduced unnecessary procedures, earlier disease detection, and optimization of healthcare resources (7,8,16). AI-enabled precision medicine approaches have also demonstrated potential to improve value-based care by matching therapies to patients most likely to benefit from treatment (17).

Furthermore, AI facilitates the utilization of real-world evidence from electronic health records and claims databases. These data sources provide insights into treatment effectiveness, medication adherence, healthcare utilization, and long-term outcomes in routine clinical practice (4,18). For hospital pharmacists, AI-driven real-world evidence analyses may support more accurate assessments of medication value and inform local formulary and procurement decisions.

3. Risks and Challenges

Despite its promise, AI introduces significant methodological and ethical concerns. One of the most frequently cited risks is algorithmic bias. AI systems trained on incomplete, inaccurate, or unrepresentative datasets may generate biased predictions that disproportionately affect vulnerable populations, potentially resulting in inequitable healthcare decisions and misleading economic evaluations (9,19).

Transparency and interpretability represent additional challenges. Many machine learning models function as “black-box” systems, making it difficult to understand how predictions are generated and limiting the ability of clinicians and pharmacists to evaluate the validity of AI-assisted recommendations (10,19). Lack of explainability may undermine trust among healthcare professionals and decision-makers responsible for resource allocation.

The dynamic nature of AI systems further complicates economic evaluation. Traditional pharmacoeconomic models generally assume stable intervention characteristics over time; however, AI algorithms may continuously evolve as new data become available (3,20). Existing HTA and economic evaluation frameworks were not specifically designed for adaptive technologies, creating uncertainty regarding long-term effectiveness, reproducibility, and cost-effectiveness estimates (3,7).

Data quality remains another critical concern. Missing data, coding errors, inconsistent documentation, and limited interoperability between healthcare systems can adversely affect AI performance and produce unreliable outputs (4,11). Several reviews have highlighted methodological weaknesses in published economic evaluations of AI interventions, including inadequate reporting of implementation costs, insufficient sensitivity analyses, and poor characterization of uncertainty (7,8). Such limitations may lead to overestimation of economic value and hinder informed decision-making.

Regulatory, legal, and privacy considerations also require attention. Questions regarding accountability for AI-generated recommendations, patient consent, cybersecurity, data ownership, and compliance with healthcare regulations remain incompletely resolved in many jurisdictions (9,13).

Hospital pharmacists involved in AI-supported decision-making must ensure that these technologies are implemented responsibly and ethically.

4. Implications for Hospital Pharmacists

AI is unlikely to replace hospital pharmacists; rather, it is expected to augment their capacity to conduct sophisticated pharmacoeconomic analyses and support evidence-based decisions. Pharmacists possess the clinical expertise necessary to interpret AI-generated findings, assess methodological validity, and integrate economic evidence into patient-centered care strategies (2,14). As AI adoption expands, pharmacy professionals will require greater competency in data science, health informatics, and digital health technologies.

Hospital pharmacists should actively participate in the development, validation, implementation, and governance of AI systems used in economic evaluation and formulary management. Collaboration among pharmacists, health economists, clinicians, data scientists, and policymakers will be essential to ensure transparency, accountability, and clinical relevance (12,20,21). Professional organizations and academic institutions should also incorporate AI literacy and digital health competencies into pharmacy education and continuing professional development programs.

5. Conclusion

AI presents both substantial opportunities and significant risks in pharmacoeconomic evaluation. Its ability to automate evidence generation, improve predictive modelling, support real-world evidence analyses, and optimize healthcare resource allocation may strengthen economic decision-making within hospitals. Nevertheless, concerns related to bias, transparency, data quality, regulatory oversight, and methodological rigor must be addressed before widespread implementation. Hospital pharmacists are uniquely positioned to bridge the gap between technological innovation and clinical application, ensuring that AI serves as a reliable decision-support tool rather than a substitute for professional judgment. Future success will depend on rigorous validation, appropriate governance, and continued pharmacist leadership in evidence-based healthcare.

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