

What are potential uses of AI in pharmacy practice?



Dispensing

- Data entry: type and bill prescriptions to reduce data entry errors.^{11,15}
- Medication order review: identify dosing errors, drug interactions, or contraindications.¹¹
- Improve accuracy of dispensing from automated and robotic systems.^{3,11}
- MedAware was able to accurately identify clinically important potential medication errors (dosing errors, duplication) or adverse effects, while reducing "alert burden" compared to rule-based systems.⁶⁻⁹



Refill Requests/Improve Adherence

- Verify correct patient/correct medication, triage refill requests, contact patient when refill is ready.^{18,19,31}
- Send personalized refill reminders, medication reminders, and dosing instructions, and monitor adherence.^{27,28,30}
- AI can select the best communication method, information, and message timing for each patient.²⁸



Streamline Communication or Administrative Functions

- Take or summarize meeting notes, optimize scheduling, help write performance evaluations.^{14-16,25}
- Draft rejection messages, faxes, e-mails, and portal notes.²⁵



Drug Information

- Perform literature searches or search drug information databases.¹⁴ (Note that ChatGPT has significant limitations as a drug information resource.^{10,13})



Medication Therapy Management (MTM)

- Identify patients who can benefit most from pharmacist intervention, as part of MTM or in a hospital setting.^{2,4}
- Summarize patient profile information for the pharmacist to review before an MTM appointment.¹
- ChatGPT 4.0 was able to flag drug interactions, suggest alternative pharmacotherapy regimens, and design a management plan in a small study.¹ However, clinical pharmacists outperformed ChatGPT in very complex cases.
- Surveyor AI has been used to identify patients who could most benefit from MTM/CMM.⁴ It identified additive adverse effects, duplicate drugs, and drug interactions.⁴ It reduced cost of medications and cost of care, ED visits, hospital admissions, and bed days in Medicaid patients with multiple comorbidities taking an average of 25 medications.⁴



Patient Education

- Assist with answering patient questions in lay terms.¹¹
- Translate patient education materials.²⁰
- Craft responses to patient portal messages.¹⁷



Inventory Management

- Manage inventory (e.g., forecast demand and automate reordering to reduce shortages or overstock)^{11,31}
 - AI can predict demand for antivirals or antibiotics based on local outbreaks.¹¹



Vaccination and Testing Services

- Streamline services by providing recommendations for staffing and inventory at each location based on current and predicted future infection rates, local appointment trends, potential supply chain issues, and staffing availability.²⁶



Teaching/Precepting

- Write case studies for students^{14,25}
- Simulate patient scenarios (including emotions) for roleplay training.³⁴



Clinical Care

- Suggest doses.¹²
- Assist with antimicrobial stewardship.²⁷
 - Machine learning algorithms reduced wrong antibiotic prescriptions, C. difficile, resistance rates, and length of stay at one health system.²⁷
- Automate delirium risk stratification.⁴⁰
- Analyze blood pressure or glucose readings from kiosks and wearables, to prompt timely pharmacist interventions and even suggest medication dose adjustments.^{1,22-24}
- MedAware was able to flag outpatients at high risk of opioid use disorder with considerable agreement with clinicians' assessment.⁵

What are some general AI concepts for pharmacists?

- AI refers to systems that do things that usually need the input of human intelligence.³² AI can look like different things, everything from grammar checkers to literature summaries to automated patient review activities. Generative AI uses machine learning (i.e., algorithms that allow it to learn without specific instructions) to analyze data to create new content, solutions, or insights.^{6,32} For example, this means that alerts generated by AI are typically more clinically actionable than those coming from traditional alerting systems that are based on predefined criteria.⁹ A specific type of generative AI is the large language model, which specializes in text generation.³²
- Some AI tools are developed internally by health systems for their own use, but others are commercially available.¹²
- AI tools should be used only in a way that does not compromise patient privacy.^{2,3}
- AI is used as a tool to improve work efficiency and enhance, not replace, clinical judgement.³ AI won't replace pharmacists or pharmacy technicians, but those who use AI might replace those who don't.
- For any AI tool to work in pharmacy, it must be trained, tested, and continuously evaluated by domain experts.³³ Pharmacists bring the clinical knowledge that guides AI toward safe and meaningful use. In fact, AI opens a new pathway for pharmacists to shape and oversee technology in patient care.³³
- Pharmacists should be aware of the limitations of the AI tools in their practice, such as potential for:
 - biased responses due to limitations of the database that the AI was trained on (e.g., incomplete data; patient population in the database is non-representative).³
 - "hallucinations" (e.g., creating non-existent reference citation; information does not exist in cited reference).²⁵
 - provision of answers that are biased, false, outdated, or not applicable to your specific patient scenario.^{15,25,32} Be aware, the answer may sound plausible.³²
- AI tools' processes should be explainable, meaning that how and why the AI tool makes decisions should be transparent to users.³²
- When incorporating an AI tool into practice, have a process for monitoring its impact on patient care.²¹
- Most studies of AI in healthcare have been retrospective and results may be applicable only to the setting in which they were performed.³ Be alert for AI-related problems and limitations specific to your practice.
- Conversations with providers, colleagues, and patients are a vital part of pharmacy care. Some clinicians express concern that younger generations will lose, or never develop, essential interpersonal communication skills due to overreliance on AI. Use AI to augment, not replace, human interaction.³⁵ Student training can include patient simulations, reflective practice, and communication workshops.³⁶⁻³⁸ Model effective interpersonal skills.³⁹
- The computing power of AI requires a lot of electricity. The environmental concerns are being addressed by use of renewable energy and more efficient computing.²

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Abbreviations: CMM = comprehensive medication management; ED = emergency department; MTM = medication therapy management

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