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Artificial Intelligence in Pharmacy Practice

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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 that 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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Resources for Discussing Medical Misinformation

This chart provides resources to help you communicate with patients about medical misinformation. Many of these resources are intended for use by the public, so you can share them with patients, or use their wording to help frame your explanations in easily understandable terms.

Resources with general tips for communicating with patients who have been exposed to confusing or inaccurate medical information

• *Messaging for Trust in Health Communication* from the Coalition for Trust in Health Information (https://trustinhealthandscience.org/wp-content/uploads/2024/11/MessagingForTrustHealth_508-1.pdf)
  o A summary wallet card is available at: https://trustinhealthandscience.org/wp-content/uploads/2024/11/MessagingTrustWalletCard-508-1.pdf.
• *A Community Toolkit for Addressing Health Misinformation* from the Office of the U.S. Surgeon General (https://www.hhs.gov/sites/default/files/health-misinformation-toolkit-english.pdf).
• *Using Psychological Science to Understand and Fight Health Misinformation*, a consensus statement from the American Psychological Association (https://www.apa.org/pubs/reports/misinformation-consensus-statement.pdf).
• *The Public Health Communications Guide to Misinformation* from Public Health Communications Collaborative (https://publichealthcollaborative.org/wp-content/uploads/2024/11/The-Public-Health-Communicators-Guide-to-Misinformation.pdf)
• *A Practical Guide to Prebunking Misinformation* from a collaboration between University of Cambridge, BBC Media Action, and Jigsaw (a team at Google)(https://prebunking.withgoogle.com/docs/A_Practical_Guide_to_Prebunking_Misinformation.pdf)
  o "Prebunking" is a preventive measure used to counter misinformation before it spreads.
• *Tackling Rumors and Understanding & Strengthening Trust (TRUST) in Public Health* from Johns Hopkins Bloomberg School of Public Health (https://centerforhealthsecurity.org/trust)

Resources and tips to combat vaccine misinformation

• General
  o Advise patients to be skeptical of things they see on the social media about vaccines, as much of the information is false.
  o Ease fears using our resource, *Vaccine Adherence: Addressing Myths and Hesitancy*.
  o See the CDC's page, *Explaining How Vaccines Work* (https://www.cdc.gov/vaccines/basics/explaining-how-vaccines-work.html).
  o To counter concerns about a link between vaccines and autism, see *Do Vaccines Cause Autism?* from Autism Speaks (https://www.autismspeaks.org/do-vaccines-cause-autism).
  o To address concerns about **fetal cells** in vaccines, see Children's Hospital of Philadelphia resource, *Vaccine Ingredients* (https://www.chop.edu/vaccine-education-center/vaccine-safety/vaccine-ingredients/fetal-tissues).
  o For patients who prefer "natural immunity" over vaccines, explain that it is not worth the risk. Out resource, *Vaccine Adherence: Addressing Myths and Hesitancy* provides examples of disease risk vs vaccine risks.
  o See the CDC's page, *How Vaccines are Developed and Approved for Use* (https://www.cdc.gov/vaccines/basics/how-developed-approved.html).

- Flu vaccines
  - Our chart, *Communicating About Flu Vaccination*, helps answer questions about flu vaccine efficacy, use in immunocompromised or pregnant patients, and more.
  - See the CDC's *Misconceptions About Seasonal Flu and Flu Vaccines* at https://www.cdc.gov/flu/prevention/misconceptions.html to help address concerns such as getting the flu from the flu vaccine.

- COVID vaccines
  - Our chart, *COVID-19 Vaccines* (US)(Canada) has a frequently asked question section that addresses safety and efficacy questions.
  - The CDC's *COVID-19 Vaccine Basics* has an infographic to help explain how mRNA vaccines work (https://www.cdc.gov/covid/vaccines/how-they-work.html).

- Childhood vaccines
  - See the CDC's *Multiple Vaccines at Once* (https://www.cdc.gov/vaccine-safety/about/multiples.html).
  - To counter concerns about a link with autism, see *Do Vaccines Cause Autism?* from Autism Speaks (https://www.autismspeaks.org/do-vaccines-cause-autism).
  - *Talking to Patients About Measles, Vitamin A and the Importance of Vaccination* is available from the Infectious Diseases Society of America at https://www.idsociety.org/science-speaks-blog/2025/talking-to-patients-about-measles-vitamin-a-and-the-importance-of-vaccination/.

Resources regarding supplements

- General
  - Look up information about safety and efficacy of specific supplements using our *NatMed* database.
  - Dietary Supplement Fact Sheets are available from the NIH's Office of Dietary Supplements (https://ods.od.nih.gov/factsheets/list-all/).

- Supplements for infectious diseases (e.g., colds, flu)
  - See *Dietary Supplements for Immune Function and Infectious Diseases* fact sheets from the NIH's Office of Dietary Supplements for healthcare professionals (https://ods.od.nih.gov/factsheets/ImmuneFunction-HealthProfessional/) and patients (https://ods.od.nih.gov/factsheets/ImmuneFunction-Consumer/).
  - See Dietary Supplements in the Time of COVID-19 fact sheet from the NIH's office of Dietary Supplements for healthcare professionals (https://ods.od.nih.gov/factsheets/COVID19-HealthProfessional/).

- Supplements for brain health
  - Our chart, *Alzheimer's Disease Pharmacotherapy* has a section on natural products for dementia.

- Supplements and fad diets for weight loss
  - See Dietary Supplements for Weight Loss fact sheets from the NIH's Office of Dietary Supplements for healthcare professionals (https://ods.od.nih.gov/factsheets/WeightLoss-HealthProfessional/) and patients (https://ods.od.nih.gov/factsheets/WeightLoss-Consumer/).
  - See *Staying Away from Fad Diets* from the Academy of Nutrition and Dietetics (https://www.eatright.org/health/wellness/diet-trends/staying-away-from-fad-diets).

Resources regarding generic and biosimilar drugs
• To help explain the benefits of generic drugs to your patients, the FDA has patient education materials available at https://www.fda.gov/drugs/generic-drugs/patient-education. • Get our FAQ, *Facts About Biosimilars*. • To learn more about the approval process for biosimilars, see information from the FDA at https://www.fda.gov/drugs/biosimilars/review-and-approval.
Resources regarding the FDA prescription drug approval process
The FDA has several resources that are appropriate for patients, including: • Frequently Asked Questions About the FDA Drug Approval Process (https://www.fda.gov/drugs/special-features/frequently-asked-questions-about-fda-drug-approval-process). • Video series: *Overview of Our Role Regulating and Approving Drugs* (https://www.fda.gov/drugs/information-consumers-and-patients-drugs/overview-our-role-regulating-and-approving-drugs-video-series).
Resources regarding sunscreens
• Get our FAQ, *Shedding Light on Questions About Sunscreens*.

Users of this resource are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and internet links in this article were current as of the date of publication.

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