

USE OF ARTIFICIAL INTELLIGENCE IN INTERNAL MEDICINE

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Annotation: Artificial intelligence (AI) is revolutionizing medical diagnostics and patient management. Advanced imaging, automated laboratory workflows, and predictive analytics enhance diagnostic precision and clinical decision-making. AI also identifies subtle clinical signs that may be overlooked by human observation, thereby contributing to early detection and personalized treatment.

Keywords: Artificial intelligence, patient–specialist interaction, decision support systems, explainable AI, digital transformation, predictive analytics, medical imaging.

Introduction

The rapid evolution of AI is transforming multiple aspects of society, with healthcare being one of the most affected domains. AI technologies have the potential to enhance efficiency, improve diagnostic accuracy, optimize treatment plans, and reduce healthcare costs.

In internal medicine, AI adoption varies according to clinical specialties, technological maturity, and regulatory approvals. The integration of AI can support physicians in diagnostics, therapy planning, administrative tasks, and patient monitoring. Moreover, AI can facilitate patient engagement by providing accessible, reliable health information, thereby empowering individuals to make informed decisions about their care.

Trust and Explainability in AI

Two primary challenges impede the full adoption of AI in clinical practice:

Reliability of AI outputs – Clinical decisions based on AI require validated and reproducible results. AI algorithms must demonstrate consistent performance across diverse patient populations and clinical scenarios.



Explainability of decision-making – Healthcare professionals must understand the rationale behind AI recommendations to make informed clinical decisions. Explainable AI (XAI) provides transparency, allowing clinicians to verify the data and reasoning that lead to AI-generated conclusions.

For instance, systems that enable physicians to review original datasets alongside AI-generated analyses increase trust and clinical adoption. Without transparency, even highly accurate AI models may face limited acceptance due to ethical and medico-legal concerns.

Clinical Applications of AI

1. Cardiology – Diagnosis and Monitoring

Photoplethysmography (PPG) signals obtained through wearable sensors or smartphone cameras allow for continuous cardiovascular monitoring. AI algorithms can detect arrhythmias, such as atrial fibrillation, and predict cardiovascular events.

Long-term blood pressure monitoring devices utilize pulse wave morphology analysis to track hemodynamic changes. Studies indicate that AI-assisted monitoring improves hypertension management, reduces hospitalizations, and enables early intervention in high-risk patients [5].

2. Endocrinology – Diabetes Management

AI-driven insulin delivery systems, often referred to as “artificial pancreas” devices, continuously monitor glucose levels and adjust insulin dosing in real-time. By analyzing continuous glucose monitoring (CGM) data and other metabolic parameters, AI can optimize glycemic control, reduce hypoglycemic episodes, and improve overall patient quality of life [6,7].

Clinical trials have demonstrated that AI-assisted insulin management reduces HbA1c levels and minimizes glycemic variability compared to conventional management, highlighting its efficacy in both type 1 and type 2 diabetes.

3. Rheumatology

AI supports the detection and management of autoimmune disorders, such as rheumatoid arthritis. By integrating laboratory data, imaging modalities (e.g., MRI, ultrasound), and clinical assessments, AI assists in early diagnosis, monitoring disease progression, and tailoring individualized treatment plans. AI-driven predictive models can also forecast flares or disease remission, enabling proactive adjustments to therapy, which is critical for preventing joint damage and improving long-term outcomes.

4. Nephrology

In nephrology, AI facilitates early detection of acute kidney injury (AKI) and monitoring of chronic kidney disease (CKD). AI models analyze serum biomarkers, urine parameters, and imaging data to identify patients at risk, predict disease progression, and guide timely interventions [8]. AI-supported decision-making has been shown to reduce the incidence of



dialysis initiation in high-risk patients by enabling early pharmacologic and lifestyle interventions.

5. Gastroenterology

AI-assisted analysis of endoscopic images aids in the detection of colorectal polyps, early neoplasms, and inflammatory bowel disease-related changes. Early identification of such lesions improves cancer prevention, enhances treatment outcomes, and supports real-time decision-making during endoscopic procedures [9].

6. Intensive Care – Sepsis Monitoring

Sepsis is a time-critical condition with high morbidity and mortality. AI can predict sepsis onset by analyzing continuous vital signs, laboratory data, and electronic health record information. Early detection facilitates timely intervention, reduces ICU length of stay, and decreases mortality rates [10].

7. Infectious Diseases

AI integrates clinical, laboratory, imaging, and epidemiological data to detect infections, assess severity, and provide treatment recommendations. During the COVID-19 pandemic, AI-assisted monitoring of temperature, oxygen saturation, and symptom progression allowed for early identification of at-risk patients and guided resource allocation [11,12]. Wearable devices can measure peripheral skin temperature; AI algorithms then estimate core body temperature, compensating for factors such as ambient conditions and sensor limitations [13].

8. Psychiatry

Heart rate variability (HRV) analysis via AI provides sensitive markers for mental health monitoring, including depression and burnout syndrome [14,15]. AI facilitates long-term, continuous patient tracking, supports therapeutic oversight, and allows early detection of symptom recurrence.

Medical Imaging Diagnostics

AI excels in interpreting imaging data from X-rays, CT, and MRI scans, identifying abnormalities with high sensitivity and specificity. Examples include early detection of malignant lesions and diabetic retinopathy [16,17].

Workflow Integration:

1. AI performs preliminary analysis.
2. Specialists review and confirm findings.

This approach enhances diagnostic accuracy, reduces human error, and alleviates clinician workload. AI-assisted handheld ultrasound devices are emerging as portable diagnostic tools that may complement or replace traditional stethoscopes [19].



Interactions Between AI, Medical Professionals, and Patients

AI empowers patients by providing accessible health information and decision support. Chatbots and interactive platforms explain symptoms and treatment options, promoting patient autonomy [20]. Nevertheless, human empathy, emotional support, and professional judgment remain irreplaceable. Balanced integration ensures that AI enhances care without diminishing the human aspect [21].

Visualization and Data Classification

AI organizes large volumes of heterogeneous clinical data into intuitive visual formats, supporting decision-making. Explainable outputs allow clinicians to assess data provenance and reliability, especially when patient-provided sensors are used. Proper algorithm selection ensures intended clinical use aligns with patient needs.

AI can automate administrative tasks such as documentation, calculation verification, and preliminary report generation, allowing clinicians to focus on direct patient care [22].

Integration into Healthcare Systems

Deep integration of AI into healthcare infrastructure ensures secure data transmission, validated sensor utilization, and automated analysis. Home monitoring systems, including “hospital at home” programs, enable continuous, outpatient surveillance. Complex systems combining vital signs, activity levels, and biometrics allow early detection of deteriorating conditions while minimizing false positives.

Practical Conclusions

The integration of artificial intelligence (AI) into healthcare, particularly within the field of internal medicine, presents unprecedented opportunities to transform patient care at multiple levels. By automating routine administrative tasks, AI reduces the workload of healthcare professionals, allowing them to allocate more time to direct patient interactions, clinical decision-making, and personalized care planning. This can lead to enhanced efficiency, reduced errors in documentation and billing, and improved overall workflow in medical institutions.

In diagnostics, AI improves the detection, characterization, and monitoring of diseases through advanced data analytics, predictive modeling, and integration of multi-modal information, including laboratory results, medical imaging, and patient-generated health data. For instance, AI-assisted analysis of electrocardiograms, photoplethysmography signals, and imaging data enables earlier detection of conditions such as atrial fibrillation, diabetic complications, kidney disease, and malignancies. Early detection facilitated by AI not only enhances clinical outcomes but also reduces hospitalizations, healthcare costs, and morbidity associated with delayed interventions.

Therapeutically, AI supports the personalization of treatment plans. Systems such as AI-controlled insulin delivery for diabetes management, predictive monitoring for sepsis in intensive care, and AI-assisted guidance in chronic disease management illustrate the potential



to tailor interventions to the individual patient's needs. This enhances treatment efficacy, minimizes adverse events, and contributes to improved patient quality of life.

Moreover, AI enhances the accessibility of medical knowledge and fosters patient engagement by providing comprehensible information, decision support, and interactive guidance. While AI augments human decision-making, it is crucial to recognize that it cannot replace the empathetic, communicative, and ethical dimensions of clinical care. Maintaining a balanced integration ensures that human oversight, empathy, and professional judgment remain central to healthcare delivery.

Data protection, system transparency, and algorithm explainability remain critical considerations. Reliable, validated, and explainable AI models are essential to maintain trust among clinicians and patients alike. Effective integration also requires robust technological infrastructure, secure data transmission, and regulatory compliance to ensure patient safety and high-quality care.

In conclusion, AI in internal medicine serves as a powerful adjunct to human expertise. When implemented thoughtfully, it has the potential to enhance diagnostic accuracy, optimize therapeutic strategies, streamline administrative workflows, and improve patient engagement. Ultimately, the goal is a synergistic healthcare ecosystem where AI amplifies clinical capabilities, preserves human empathy, and supports the delivery of efficient, safe, and personalized care for all patients.

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