Artificial intelligence in general medicine and dermatology: a comprehensive review

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Abstract

Background: Artificial intelligence (AI) has rapidly transitioned from a conceptual innovation to a practical tool across multiple areas of clinical medicine. Dermatology, in particular, has emerged as a leading specialty for AI integration due to its strong reliance on visual pattern recognition and image-based diagnostics.
Aim: This review aims to summarize fundamental concepts of AI, outline its applications across general medicine, and provide an in-depth analysis of current and emerging AI applications in dermatology.
Methods: A narrative review of the contemporary literature was performed, focusing on AI applications in clinical medicine and dermatology, including diagnostic support, treatment planning, telemedicine, education, and regulatory considerations.
Results: AI systems have demonstrated diagnostic performance comparable to clinicians in selected tasks, particularly in dermatological imaging and skin cancer detection. Applications extend beyond oncology to inflammatory skin diseases, dermatopathology, teledermatology, and clinical decision support. However, challenges remain regarding data bias, interpretability, real-world validation, ethical concerns, and clinical workflow integration.
Conclusions: AI represents a transformative technology in general medicine and dermatology, with the potential to enhance diagnostic accuracy, efficiency, and access to care. Responsible implementation, rigorous clinical validation, and attention to ethical and equity considerations are essential for safe and effective clinical adoption. **TCM-GMJ June 2026; 12 (2): P29-P37)**

Keywords: Artificial intelligence; Machine learning; Dermatology; Clinical decision support; Teledermatology; Precision medicine

Introduction

Artificial intelligence has evolved from an aspirational concept into a working reality across multiple domains of clinical medicine, with particularly robust applications in dermatology due to the specialty's inherently visual nature [1,2]. The integration of AI into healthcare represents a transformative shift in how clinicians approach diagnosis, treatment planning, and patient care delivery. This review examines the fundamental principles of AI in medicine, explores its broad applications across general medical practice, and provides an in-depth analysis of AI's specific role in dermatology.

Methods

This review was conducted as a narrative synthesis of peer-reviewed literature addressing artificial intelligence applications in general medicine and dermatology. Publications were selected based on relevance to clinical implementation, diagnostic performance, regulatory approval, ethical considerations, and future directions. Both foundational and recent studies were included to provide a comprehensive overview. As this study involved analysis of previously published data, ethical approval and informed consent were not required.

Results and discussion

Fundamental concepts of artificial intelligence in medicine

Artificial intelligence encompasses computational systems designed to perform tasks that traditionally require human intelligence, including pattern recognition, decision-making, and problem-solving [2,3]. Machine learning, a core subset of AI, enables algorithms to learn from data without explicit programming by identifying patterns and generating predictive models. Deep learning represents the most advanced form of machine learning currently applied in medicine and relies on multilayer artificial neural networks capable of automatically extracting complex features from large and heterogeneous datasets.

In medical imaging applications, early neural network layers identify simple visual elements such as edges, con-

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Received May 3, 2026; accepted May 28, 2026.
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trast, and color gradients, while deeper layers recognize higher-order features including tissue architecture and pathological patterns [3,4]. These hierarchical learning processes allow AI systems to achieve high diagnostic performance in image-rich specialties.

How AI systems learn in clinical medicine

Most clinical AI systems rely on supervised learning, in which algorithms are trained using labeled datasets, such as annotated radiologic images or dermatologic photographs classified by diagnosis [3,4]. Through iterative exposure to training data, models refine their predictive accuracy. Convolutional neural networks have become the dominant architecture for medical image analysis due to their ability to detect spatial hierarchies and visual patterns with high efficiency.

AI applications across general medicine

AI has demonstrated transformative potential across multiple medical specialties [1,5,6]. In radiology, algorithms assist with interpretation of radiographs, computed tomography, and magnetic resonance imaging, often achieving diagnostic accuracy comparable to expert clinicians for selected tasks. In pathology, AI systems analyze digitized histopathological slides to identify malignant cells, grade tumors, and predict disease progression.

Beyond imaging, AI applications extend to analysis of electronic health records to identify patients at risk for sepsis, heart failure, or hospital readmission. Predictive analytics integrate laboratory values, clinical histories, and genomic data to support personalized treatment planning and early intervention strategies. AI-driven tools also optimize medication dosing, reduce adverse drug events, and support clinical trial design and drug discovery [7].

Operationally, AI enhances healthcare efficiency through automated scheduling, resource allocation, documentation, and administrative workflows. Natural language processing supports clinical documentation and coding, while virtual assistants and chatbots assist with patient education, triage, and chronic disease management. AI has also contributed to public health surveillance by monitoring disease outbreaks and predicting epidemic trends [7].

AI in dermatology

Dermatology is particularly well suited for AI integration due to its reliance on visual pattern recognition and the availability of large image datasets [2,4]. AI applications in dermatology span skin cancer detection, inflammatory and autoimmune skin disease assessment, dermatopathology, teledermatology, and integration with advanced imaging technologies.

The most extensively studied application is skin cancer detection, particularly melanoma [2,8,9]. Multiple studies have demonstrated that deep learning algorithms can match or surpass dermatologist-level accuracy in distinguishing malignant from benign lesions. Several regulatory -approved AI devices are currently available, primarily focused on melanoma screening, with international platforms offering broader condition coverage.

Beyond oncology, AI systems address inflammatory skin conditions such as psoriasis, eczema, acne, and atopic dermatitis by assessing disease severity, tracking treatment response, and predicting flares [9–11]. Integration with dermoscopy, optical coherence tomography, and three-dimensional imaging enables comprehensive lesion mapping and longitudinal monitoring.

AI applications in dermatopathology include automated analysis of histological slides, tumor classification, and correlation of morphological patterns with molecular signatures [11-14]. Teledermatology platforms enhanced by AI improve access to care in underserved regions and support triage and referral decisions.

Challenges and limitations

Despite promising performance, several challenges limit widespread clinical adoption. Dataset bias remains a major concern, as many AI systems are trained predominantly on images from lighter skin types, reducing accuracy in diverse populations [11,15,16]. Image quality variability, limited interpretability of deep learning models, and lack of transparency further complicate clinical trust.

Most AI studies have been conducted in controlled research environments, with limited real-world clinical validation [4,8,12]. Prospective trials and outcome-based studies are required to demonstrate impact on patient outcomes, cost-effectiveness, and workflow efficiency. Ethical considerations include data privacy, accountability for diagnostic errors, and potential exacerbation of healthcare disparities.

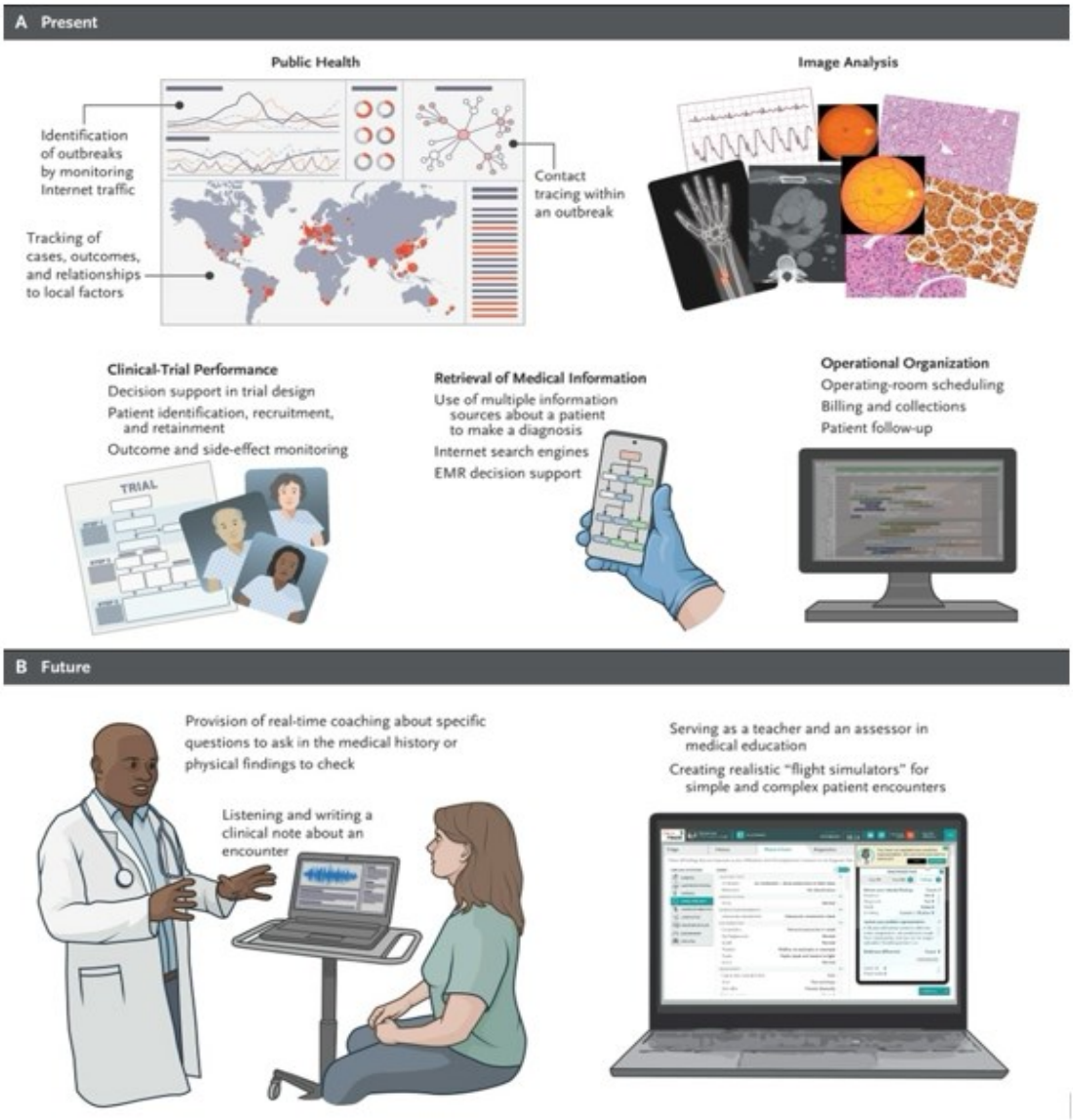
Future directions

Emerging paradigms include multimodal AI systems that integrate imaging, clinical notes, laboratory data, and genomics [16]. Large language models may function as clinical assistants, documentation tools, and decision-support systems. Federated learning and adaptive algorithms offer opportunities for continuous improvement while preserving data privacy. AI has potential to enhance global health equity by extending dermatologic expertise to resource-limited settings.

Conclusion

Artificial intelligence has transitioned from theoretical promise to practical application in both general medicine and dermatology [1,2,5]. While current evidence supports its diagnostic and operational potential, widespread adoption requires rigorous validation, ethical governance, clinician training, and careful integration into clinical workflows.

Figure 1. Spectrum of Artificial Intelligence (AI) in Medicine. Artificial Intelligence and Machine Learning in Clinical Medicine, 2023. N Engl J Med. March 30, 2023 (Used under license from The New England Journal of Medicine. Fundamental).



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