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Title:
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Date:
2025-06-27

Citation:
Scott, I. A., Shaw, T., Slade, C., Wan, T. T., Barmanray, R., Coorey, C., Johnson, S. L., Bell, L., Herd, M. & Sullivan, C. M. (2025). Proposing core competencies for physicians in using artificial intelligence tools in clinical practice. Internal Medicine Journal, 55 (8), pp.1-1. https://doi.org/10.1111/imj.70112.

Persistent Link:
https://hdl.handle.net/11343/356928

INTERNAL MEDICINE JOURNAL

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doi:10.1111/imj.70112

VIEWPOINT

Proposing core competencies for physicians in using artificial intelligence tools in clinical practice

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Key words
artificial intelligence, clinical practice, competencies, core, physicians.

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Received 20 January 2025; accepted 3 May 2025.

Abstract

Artificial intelligence (AI) will likely transform many aspects of healthcare, and physicians will need to adapt and lead. The expanding range of AI tools calls for physicians to become competent in their proper use if we are to achieve better patient experience, population health and health equity, and with greater efficiency, while enhancing physician satisfaction. This viewpoint proposes a practical and manageable set of core competencies for physicians in using AI tools effectively and ethically and suggests methods for acquiring these competencies.

Introduction

Artificial intelligence (AI), broadly defined as computer systems capable of mimicking human intelligence, will likely transform many aspects of healthcare, and physicians will need to adapt and lead. The advent of generative AI in the form of large language models (LLMs) is already impacting clinical practice with ambient AI scribes and AI-enabled decision support.[1] All specialties and all tasks (diagnosis, treatment, prognostication) are likely to be influenced, as will various clerical and administrative functions performed by health professionals and information searching by patients. AI tools for predicting risk of sepsis, interpreting radiology or endoscopic images, and detecting clinical deterioration are already deployed in various Australian healthcare organisations.[2] Health professionals and patients in general hold positive views of using AI to assist care if certain safeguards are met.[3] Repetitive, routine tasks may be done by AI tools, enabling greater attention to higher-order, irreducibly human elements of care. However, the evidence-based medicine movement taught clinicians to appraise new interventions critically before large-scale adoption, and AI tools are no exception. Their expanding range calls for physicians to become competent in their proper use in achieving the Quintuple Aim of better population health, patient experience and health equity together with greater efficiency and physician satisfaction.

In this viewpoint, we propose a practical set of core competencies for physicians in using AI tools effectively and ethically (Table 1) and suggest methods for acquiring these competencies. We define competencies as the demonstrable knowledge, skills, abilities and behaviours that contribute to individual and organisational performance. While several groups have proposed AI competencies for health professionals,[4–6] none target practising physicians, most focus on undergraduate curricula and all predate the advent of generative AI.

Foundational knowledge of AI tools

While not expected to become AI experts, physicians will need to understand key concepts and terminology pertaining to machine learning (ML) models used for classification or prediction tasks, deep learning (DL) models applied to computer vision or speech recognition and

Funding: None.
Conflict of interest: None.

Table 1 Proposed list of core competencies in AI

Domain	Competencies – the competent physician
Foundational knowledge of AI tools 'What are these AI tools?'	• Differentiates between the different types of AI – machine learning, deep learning, generative AI with large language models (LLMs). • Knows the key steps and processes in how AI-based tools are developed, evaluated, implemented and monitored over time. • Understands the limitations of AI tools (such as biased models, data drift, LLM hallucinations) and how these can be recognised and mitigated. • Knows the current and emerging range of AI tools relevant to physician practice. • Understands how AI tools can systematically affect the cognitive processes and clinical actions of human users ('automation bias'). • Understands the regulatory, legal, ethical, privacy and data security standards at local, state and national levels that apply to AI tools.
Critical appraisal of AI tools 'Should this AI tool be used?'	• Assesses the accuracy, safety, contextual appropriateness and limitations of AI tools in providing care to patients and populations. • Interprets the performance metrics applied to AI models according to their type and task. • Determines if AI models have been subjected to both internal and external validation. • Discerns if AI models have been subjected to prospective evaluation using live (or near live) data. • Applies appraisal guides in deciding the suitability of AI tools for specific tasks. • Interprets factsheets or model cards detailing attributes of an AI model or tool. • Applies risk assessment to AI tools being considered for implementation. • Critically appraises clinical studies of AI tools that use different study designs.
Use of AI tools 'How to best use this AI tool'	• Identifies the appropriate population, context and indications for using AI tools of different types and functions. • Executes the human-computer tasks needed to operate AI tools in a manner that builds mastery and efficiency. • Demonstrates effective prompt design and querying of LLMs to obtain accurate and informative outputs. • Analyses and adapts to changes in teams, roles, responsibilities and workflows resulting from implementation of AI tools. • Identifies when and why AI model performance is degrading and requires either retraining or retirement. • Anticipates and recognises the potential adverse effects of AI tools and takes appropriate actions to mitigate or address unintended consequences. • Assumes responsibility for all patient care decisions that involve support from AI tools and exercises judgement in applying AI-generated predictions or advice. • Demonstrates adherence to guidelines, codes of conduct and etiquette standards regarding the clinical use of AI tools.
Patient interaction with AI tools 'How to involve patients when using AI tools?'	• Communicates to patients in comprehensible lay terms what the AI tool is, how it works, why it is being used and its limitations. • Adheres to legal standards for obtaining patient consent to use AI tools. • Answers questions about accuracy, privacy and confidentiality and obtains patient consent. • Engages in shared decision making using the AI tool in a manner that preserves or augments the physician-patient relationship.
Professionalism and AI tools 'What are our responsibilities in advancing the use of AI tools?'	• Collaborates with data and informatics professionals in designing and evaluating AI tools that address important clinical problems. • Participates collaboratively in team-based discussions around changing roles, responsibilities and workflows associated with the adoption of novel AI tools and helps implement necessary changes in systems of care. • Maintains awareness of legislative and regulatory standards that apply to AI tools and their use in clinical practice. • Contributes to micro- and macro-system discussions about barriers and enablers to wider adoption of AI tools, including financial and environmental sustainability. • Participates in training programmes, continuing professional development and practice-based improvement activities related to the use of AI tools in healthcare.

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generative AI used to generate different outputs (text, video and audio) from different inputs or prompts.[7,8] Familiarity with the key steps in developing and evaluating AI models and derivative tools lends an appreciation of where in this pipeline faults and limitations in either model or tool may develop (Figure 1).[9] Physicians will need to be alert to the potential for AI tools to influence their cognitive processes negatively, resulting in loss of situational awareness, de-skilling and over-reliance on AI-generated advice presented with undue confidence.[10] Being aware of AI tools specific to their specialty that are effective, safe and ready for implementation is important, as is staying attuned to the evolving regulatory, legal and technical standards that will likely apply to such tools.[11]

Critical appraisal of AI tools

Physicians must be assured that AI tools meet a pressing need, are accurate and reliable for their assigned tasks, pose minimal safety concerns, can cope with the nuances of clinical practice, do not cause cognitive overload or alert fatigue and can be integrated into clinical workflows.[12] In appraising any particular AI tool, key performance metrics applied to their models according to type and function need to be understood. These might comprise sensitivity, specificity, predictive values and discrimination curves for ML classification or prediction tasks,[7] and accuracy, relevance, completeness and latency metrics for LLMs.[8] Models should be externally validated on unseen datasets from other institutions separate from original training datasets. Models and tools trained on static, retrospective datasets must maintain acceptable performance when evaluated prospectively using dynamic, real-time data feeds from electronic medical records (EMRs) and/or other sources which resemble the operational environment in which they will function.

Appraisal guides (Table 2) help assess the clinical suitability of a particular AI tool and its impact on Quintuple Aim outcomes, including costs and environmental impacts of the tool itself.[13] For specific AI tools, physicians should request and be able to interpret a factsheet or model card that details its function and context, training datasets, model performance, bias evaluation, failure mode analyses, safety assessment, technical architecture, data storage, prompt engineering (for LLMs), user testing and conditions of use.[14] Tools lacking such information should be avoided. Physician users should also request a risk assessment that considers both the likelihood and

Figure 1 Key steps in developing and evaluating AI models and tools.

Table 2 Basic appraisal guide for AI tools

What is the purpose and context of the tool?
• What tasks does it perform?
• Does it address a pressing clinical problem?
How accurate and reliable is the tool?
• Are the data used as input into the tool of high quality and available when and where the tool requires it?
• Are the input data of adequate volume and are they complete, accurate, bias-free and representative of the tasks the tool will perform?
• Are the workings of the tool and the model it relies on sufficiently transparent?
• Are the tool outputs accurate, interpretable by users without errors or bias and directly applicable to clinical care?
Is the tool able to be integrated into clinical workflows with minimal disruption?
• Has the user interface been subject to user co-design and testing?
• How will the tool be used – as a distributed system (e.g. alerts provided directly to individual clinicians) or centralised system (e.g. dashboard of alerts monitored by a single dedicated user)?
• Does the tool require searching and manual data entry by users?
Is use of the tool likely to realise clinically meaningful improvements in care?
• What impact studies have been performed using clinically relevant outcome measures with defined minimally important clinical differences?
Does the tool carry risk of harming patients or compromising the physician-patient relationship?
Does the tool satisfy current governance, ethical and regulatory standards?
Is the tool financially and environmentally sustainable over its lifecycle?

impacts of (tool inaccuracy) (due to unrecognised hallucinations (fabricated information), omissions and bias), cybersecurity breaches, sparse validation on local contexts, infrastructure constraints, opportunity costs and carbon footprint.[15] Many studies comparing AI tools with standard clinical practice use retrospective designs and highly curated settings, with high risk of bias or irrelevance to routine care.[16] The required level of methodological rigour should be proportionate to the level of risk inherent to the task the tool is performing. A decision support tool will necessarily require a high evidence standard, in most cases a randomised controlled trial, while for less critical documentation tasks or data retrieval, observational studies may suffice.

Use of AI tools

Physicians must be able to identify the clinical circumstances in which use of a tool is appropriate regarding errors and biases that may apply to specific scenarios. For example, some tools may not work well in certain minority populations such as First Nations people (insufficient or unrepresentative training data), in particular sites (different equipment settings, mode of operation or, for LLMs, use of vernacular language) or in different contexts (highly time-sensitive or person-sensitive encounters).[17] Physicians must demand the necessary training and support be provided in using AI tools proficiently, participate in user testing of human-computer interfaces and visualisations of outputs during prototype development and have input into the procurement process for deployable applications. In using LLMs effectively, physicians need to construct specific, contextualised instructions (or prompts) that enable the chatbot tool to generate the most nuanced, relevant and factually correct output, with reduced risk of 'hallucinations'. Physicians will also need to adjust to any tool-related restructuring of EMR functionality (from embedded or stand-alone tools), current workflows, professional roles and interactions with other team members or with consumers accessing AI tools for information prior to any clinical encounter.

Tools will automate clerical tasks, assist physicians in decision-making and reassign certain functions, such as triage or screening, to different team members. Physicians should understand how and why task-specific performance thresholds (for ML models) and benchmark cases with chain-of-thought (CoT) reasoning (for LLMs) should be regularly applied to AI tools using auditing processes[18] and scenario testing,[19] both aimed at identifying when tool functioning is degrading to unacceptable levels. This aligns with physician accountability for all clinical actions involving AI tools and avoiding unquestioning over-reliance on such tools. Adhering to guidance on safe tool use will minimise misuse and consequent liability for harm from inputting data errors, misinterpreting output displays or clicking wrong options.[20]

Patient interaction with AI tools

Using AI tools that reconfigure the conduct of clinical encounters and directly inform clinical decisions introduces a third member into the traditional physician-patient dyad. How much trust patients will have in both the AI tool and the physician using it may depend on how well the latter can explain what the tool is, how it works and why it should be used. It is impossible to render highly complex 'black box' models fully explainable,[21] and no consensus currently exists on whether or to what extent AI tools should be inherently explainable.[22] The compromise is for tools to report key features and rationales for their outputs that physicians can comprehend and communicate and for physicians to acquire a basic understanding of tool operations. Rather than tool explainability, patients are more concerned about tool accuracy and data privacy protections[23] and desire

tools that enable physicians to spend more time interacting directly with them in shared decision-making.[24] More research needs to define patient preferences for how AI tools should be used according to the context of individual encounters.

Professionalism and AI tools

Physicians must be involved from the outset in developing AI tools that are fit for clinical purposes and learn from the pitfalls of poorly designed EMRs. This requires physicians to recognise data and informatics professionals as partners in teams within healthcare organisations and to collaborate with them in designing, evaluating, implementing and monitoring AI tools that address important clinical problems amenable to AI solutions. Tool-related changes in professional roles, responsibilities, training and work practices must be acknowledged and worked through collaboratively at the organisational level in achieving the full benefit of AI tools. Physicians will also need to be aware of system factors (such as infrastructure and resource availability, access to training data, cybersecurity and financial sustainability) that either promote or inhibit the adoption of effective AI tools and be prepared to articulate and advocate for the necessary reforms in avoiding lost opportunities to benefit from AI innovation.[25] The increasing personal use of smartphone AI applications, outside the scrutiny of healthcare organisations, also brings professional obligations regarding appropriate and cybersafe use. Finally, physicians should try to remain up to date in their understanding of rapidly evolving AI methods and tools that hold the promise of improving care while maintaining awareness of prevailing regulatory standards applied by the Therapeutic Goods Administration (available at: Is my software regulated?) and knowing which AI tools require or do not require regulatory approval (e.g. decision support tools vs ambient scribes).

Methods for acquiring AI competencies

Foundational knowledge can be imparted from academic sources using primers,[7,8] webinars, mini-courses, micro-credentialling and training modules, many available online. Qualifications in digital health should include training in AI and for those seeking a career path in clinical AI, formal degree courses are on offer from some Australian universities (see Australian digital health course directory – Digital Health CRC). These all aim to build stronger interdisciplinary partnerships with data and computer scientists and informatics personnel.

Critical appraisal skills can be acquired by consulting AI-specific checklists,[12,13,26] guidelines and research reporting standards[27,28] and incorporating these into journal clubs, topic reviews and quiz sessions, while noting standardised appraisal guides for LLMs are yet to be developed.[29]

Expertise in using AI tools can be developed using simulation exercises within sandbox environments using tool prototypes.[30] These activities also allow physicians to suggest changes to the computer interface or output visualisations that enhance user experience, help foresee tool effects on clinical workflows and provide opportunities to inform regulatory approaches to AI tools.[31]

In using LLMs, physicians will need to practise prompt engineering using simulations (or 'prompt-a-thons')[32] and scenario exercises,[33] iterating their prompts and working with colleagues in learning which tactics

Table 3 Bibliography of articles on artificial intelligence published in *IMJ*

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produce the most precise and informative outputs, and to understand the limitations and errors of LLMs.

Having to report incidents of adverse events and near misses from using AI tools and determining if these result from inherent defects in the tool or misuse by users will help raise physician skill in optimising both tool design and human-AI interactions. Having to develop threshold or benchmark standards for assessing tool impacts on diagnostic accuracy, operational efficiency or other outcomes requires physicians to understand tool performance metrics and what constitutes meaningful improvements in AI-assisted care compared to current practice.

The use of AI tools in clinical consultations will require patient consent procedures that acknowledge the limits of an individual physician's depth of knowledge about particular tools. Physicians will need to collect patient feedback on their experiences of AI-enabled encounters during the early phases of tool deployment in ensuring patient autonomy and sanctity of physician-patient relationships.

Leadership courses, supervisor development workshops and congresses of the Royal Australasian College of Physicians (RACP) could regularly feature sessions on AI. The RACP should consider establishing a 'community of AI practice' that promotes ongoing and systematically recorded discussions and sharing of insights about physicians' use of AI tools, complemented by AI articles authored by RACP members and published in *Internal Medicine Journal* (*IMJ*) (Table 3). Specialty societies could consider establishing special interest groups in AI tasked with imparting knowledge and skills related to specialty-specific AI tools to their members. Similar to sister institutions overseas,[34,35] the RACP and its affiliated specialties need to formulate position statements on their approach to AI. These should emphasise optimisation of patient outcomes allied with synergistic human-AI collaboration and ongoing vigilance and verification of AI tool outputs by appropriately trained physicians.

Conclusion

Not every physician needs to become an AI expert, but all will need to know how to scrutinise and use AI technologies effectively within their areas of practice. This non-exhaustive list of core competencies in AI is proposed as a starting point for further discussion, and which needs formally to consider consumer wishes and sentiment – a limitation of the current work, although some of us (IS, CS and CMS) have engaged extensively with consumer groups in previous AI-related projects. Such engagement is an area for future research and must feature adequate minority group representation. Additional competency domains and subcompetencies may be required for different specialties and as AI tools and systems evolve over time and are applied to more aspects of care. Incorporating AI competency training into current, already crowded curricula and professional development programmes will be challenging but necessary. Development and validation of methods for assessing these competencies among practising physicians will also be required.

Acknowledgements

The authors are all members of the RACP Digital Health Advisory Group. The views expressed in this article are solely those of the authors and should not be viewed as official policy or opinion of the RACP or any of its committees, faculties, or affiliated societies. Open access publishing facilitated by The University of Queensland, as part of the Wiley - The University of Queensland agreement via the Council of Australian University Librarians.

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