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COMMENTARY

Opportunities and Barriers of Generative Artificial Intelligence in the Training of Psychiatrists: A Competencies-Based Perspective

Hilary Y. M. Pang[1] · Shakila Meshkat[2] · Bazen Gashaw Teferra[2] · Alice Rueda[2] · Reza Samavi[3,4] · Sri Krishnan[4] · Thomas Doyle[5] · Sirisha Rambhatla[6] · Sandra DeJong[7,8] · Sanjeev Sockalingam[1,9,11] · Tanya Horsley[10] · Brian Hodges[1,10,11] · Venkat Bhat[1,2,3,11]

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Recent breakthroughs in generative artificial intelligence (GAI), such as OpenAI's ChatGPT, pose a significant disruptive potential in psychiatry. While traditional artificial intelligence (AI) excels at pattern recognition and prediction, GAI excels at content creation. GAI generates text, images, and other types of content based on patterns in the data it was trained on. Current GAI models include OpenAI's ChatGPT, Sora, DALL-E, Google's Gemini, Anthropic's Claude, Meta's LLaMa, and Microsoft's Copilot.

Currently, the development of psychiatric education curricula and assessments is a resource-intensive and time-consuming process, involving accumulating volumes of digital data and clinical literature. Recognizing the evolving applications of AI, various medical education organizations, including the American Medical Association's Council on Medical Education and the Royal College of Physicians and Surgeons of Canada (RCPSC), have recognized the importance of both reviewing and monitoring AI as well as the implications on training and practice as AI applications continue to evolve [1, 2].

There is a paucity of literature on the applications of GAI on psychiatric education [3–5]. Potential opportunities of new technologies also beget potential risks, which can be particularly consequential when applied to medicine. This commentary aims to discuss the potential opportunities and barriers of GAI in psychiatric education, mapped to national competency frameworks that guide American and Canadian medical training accreditation standards and examinations, namely the Accreditation Council for Graduate Medical Education's (ACGME) Core Competencies (and associated Psychiatry Milestones) and the RCPSC's CanMEDS Roles (and associated Objectives of Training in the Specialty of Psychiatry), respectively [6, 7].

The current opportunities and challenges can be discussed under a mapped framework of ACGME Core Competencies (as per Psychiatry Milestones) and RCPSC CanMEDS Roles (as per the Objectives of Training in the Specialty of Psychiatry) (Table 1). Sections in this discussion are categorized by equivalent *ACGME—CanMEDS* competencies.

Medical Knowledge (ACGME)—Medical Expert (CanMEDS)

Opportunities for GAI include supporting learners to demonstrate sufficient knowledge to identify and treat psychiatric conditions throughout the life cycle (as per ACGME) as well as establish clinical knowledge, skills, and attitudes appropriate to the practice of psychiatry (as per RCPSC CanMEDS). For example, employing GAI to structure and automate medical question writing is one of many emerging opportunities. Low- and high-stakes in-training and licensing examinations are foundational formative assessments

✉ Venkat Bhat
venkat.bhat@utoronto.ca

1 University of Toronto, Toronto, ON, Canada
2 St. Michael's Hospital, Toronto, ON, Canada
3 Toronto Metropolitan University, Toronto, ON, Canada
4 Vector Institute for Artificial Intelligence, Toronto, ON, Canada
5 McMaster University, Hamilton, ON, Canada
6 University of Waterloo, Waterloo, ON, Canada
7 Cambridge Health Alliance, Cambridge, MA, USA
8 Harvard Medical School, Cambridge, MA, USA
9 Centre for Addiction and Mental Health, Toronto, ON, Canada
10 Royal College of Physicians and Surgeons of Canada, Toronto, ON, Canada
11 University Health Network, Toronto, ON, Canada

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Table 1 Opportunities and challenges of generative artificial intelligence mapped to Royal College of Physicians and Surgeons of Canada (RCPSC) CanMeds Roles (and associated Objectives of Training in the Specialty of Psychiatry) and equivalent Accreditation Council for Graduate Medical Education (ACGME) Core Competencies (and associated Psychiatry Milestones)

ACGME	CanMEDS	Opportunities	Challenges
Medical Knowledge	Medical Expert	• Writing exam questions for progress testing • Importance of human oversight and feedback	• Unproven medical robustness and clinical reasoning • "Hallucinations" of content and references • Information is limited to cutoff date and copyright regulations • Reliance on prompt engineering
Practice-based Learning and Improvement	Scholar	• AI literacy as a learner competency • Summarization of scientific literature for learner and patient education	• Overreliance on GAI tools diminishing critical thinking and appraisal skills
Interpersonal Skills and Communication	Communicator	• Role-playing psychiatric interviewing as standardized patient • Template tool for medical documentation	• Risky and unhelpful chatbot responses to mental health concerns
Professionalism	Professional	• Need for creation of regulatory and medicolegal liability rules	• Lack of trust due to absence of regulatory obligations and medicolegal liability, e.g., in digital health apps • Academic integrity and privacy concerns when used by learners and faculty
Systems-based Practice	Health Advocate	• Need for data sampling from diverse sources	• Conscious and unconscious bias in algorithms
Interpersonal Skills and Communication & Patient Care	Collaborator	• Transcription and language translation for multilateral collaboration	• Lack of high-quality literature in this domain
Systems-based Practice	Leader	• Increasing efficiency of learner assessment data analysis	• Learner assessments are sensitive and need careful analysis • Expanding infrastructure needs and technological support

and professional benchmarks, but they are resource-intensive and time-consuming to create. Although guidelines exist for question writing, human writers often undergo little training in this area and standardizing the quality of exam questions is difficult. GAI has the potential to efficiently produce question banks for progress testing, a lower-stakes and formative assessment, as a means for test-enhanced learning, as compared with higher-stakes licensing examinations.

While GAI has the potential to facilitate writing assessments, the risk of GAI making errors is consequential. One study has shown that GPT-4-generated multiple choice exam questions were partially indistinguishable from human-generated United States Medical Licensing Examination (USMLE) Step 2 Clinical Knowledge questions though only 64% of generated questions were deemed valid by a panel of physicians [8]. Further research into the question quality of GAI-generated questions in psychiatric examination is warranted. The potential of an AI system to produce unintended behavior may result in unfortunate and serious consequences in human health. GAI can generate *hallucinations*, responses that are factually incorrect, misleading, or cite false references and non-existing literature. With the known hallucination problem associated with GAI, users need to differentiate the factual from false information provided by the GAI model. In a study that evaluated the medical robustness and reasoning of GPT-3.5 on USMLE, its performance on the exam worsened with open-ended questioning, it failed to indicate uncertainty or provide disclaimers in its answers, and it lacked the ability to fact-check information even when presented with its own responses [9]. These observations increase the risk of medical misinformation and inaccurate problem-solving [9]. Given that learners are not subject matter experts, it is difficult for a learner to know if they are encountering a hallucination. The reliability of the educational tool they use is paramount.

In addition, GAI is trained on large-scale datasets published before a specific knowledge cutoff date, which can limit its ability to be kept up-to-date with constantly evolving psychiatric literature [10]. The European Union's AI Act, passed in December 2023, bans the use of any copyrighted material in the training dataset, which may also diminish its medical knowledge base [11].

Being a Medical Expert also involves awareness of one's own limitations and the capacity to actively seek appropriate consultation from other health professionals. However, GAI may not have the ability for this yet. ChatGPT has been

shown to consistently use overly confident language, even when incorrect [12]. GPT-3.5 had the highest rate of hallucinations and non-logical reasoning compared to GPT-4 and Bing in one study, while another study showed comparable proportion of hallucinations between GPT-3.5 and GPT-4 [13, 14]. When generating medical articles with references, GPT-3.5 was able to deliver accurate and verifiable references for only 7% of generated responses [15].

Lastly, the responses generated by GAI models are influenced by how a question is asked. For example, GAI performs more poorly with inductive reasoning tasks compared with those using deductive reasoning, which may explain its suboptimal performance on open-ended USMLE questions [10]. Proficiency in problem formulation (defining a question by its focus, scope, and boundaries) and understanding the linguistic nuances of prompt engineering (providing specific and clear instructions) are essential competencies to master in order to use GAI models effectively [16]. Problem formulation in GAI is like a composer and conductor preparing a symphony; they define the overall vision, structure, and goals of the project as well as assess objectives, understand constraints, and design the approach. Prompt engineering is like the musicians performing the symphony, crafting and refining specific prompts to produce the desired output. Both stages are crucial, with problem formulation providing the framework and prompt engineering focusing on detailed execution.

Practice-Based Learning and Improvement (ACGME)—Scholar (CanMEDS)

ACGME describes a competency to critically appraise and apply evidence even in the face of uncertainty and conflicting evidence to guide care and a CanMEDS Scholar critically evaluates psychiatric information and its sources and applies this information appropriately to practice decisions. Integrating GAI literacy into the medical education curricula can help learners and physicians adopt a critical stance in identifying and tackling potential misinformation. The RCPSC-commissioned Task Force on Artificial Intelligence and Emerging Digital Technologies proposed that digital health literacy could be considered as a component of the CanMEDS roles and the Child and Adolescent Psychiatry Milestones of ACGME identifies the use of digital health technologies to augment patient care as a competency [1, 17].

Equally important is the ACGME competency of locating the best available evidence to the care of patients and the CanMEDS Scholar's role in contributing to the development, dissemination, and translation of new knowledge and practices. GAI can succinctly summarize research papers for learners, suggest other relevant papers for further reading, and support reasoning to derive other potential conclusions. It can simplify jargon into laypeople's terms; effectively becoming a "universal translator" for the broader dissemination of psychiatric knowledge to learners, patients, and families; create patient information materials; and significantly reduce the time spent on literature reviews. However, a concern may be that there becomes an overreliance on GAI rather than a learner's own critical thinking. Teaching critical appraisal and literature search skills continues to be important, and GAI may be another tool in the toolbox.

Interpersonal Skills and Communication (ACGME)—Communicator (CanMEDS)

Another ACGME competency involves organizing and initiating communication with patient and family by introducing stakeholders, setting the agenda, clarifying expectations, and verifying understanding of the clinical situation; a CanMEDS Communicator conveys relevant information and explanations accurately to patients and families, colleagues, and other professionals. GAI can also act as standardized patients and help learners practice their psychiatric interviewing [18]. A recent study showed GAI's comparable ability to humans to demonstrate theory of mind, the ability to track other people's mental states [19]. GAI also offers the potential to aid clinicians in medical documentation and serve as a templating tool for learners, which supports the Communicator role for effectively conveying oral and written information about a psychiatric encounter [20].

Conceptually, GAI may be used to teach psychotherapeutic interventions by role modeling psychotherapy for learners. In one study, chatbots were shown to be non-inferior to clinicians when communicating patient education in a public social media forum and optimizing treatment adherence in patients with breast cancer [21, 22]. However, considerable limitations in usability, effectiveness, safety, and confidentiality persist, with recent studies demonstrating unhelpful and risky chatbot responses to mental health issues and to individuals seeking support on eating disorders [23, 24].

Professionalism (ACGME)—Professional (CanMEDS)

ACGME recognizes the role of identifying and seeking to address system-level factors that induce or exacerbate ethical problems or impede their resolution and a CanMEDS Professional demonstrates a commitment to their patients, profession, and society through participation in profession-led regulation, including fulfilling the regulatory and legal obligations required of current practice. Currently, GAI is not under any regulatory frameworks to guide or constrain

its use in medical scenarios. The United States Food and Drug Administration (FDA) has advocated to classify AI tools as medical devices [25]. However, industry professionals have argued that general purpose large language models that have not been trained or offered specifically for clinical use do not fit under these criteria, similar to how medical information on the Internet is not regulated by the FDA. In addition, GAI's domain of expertise is ever slowly evolving with continuous improvement and regression through its interaction with its users which makes evaluation difficult [25].

Clinically, an AI system lacks legal personhood and is not subject to professional liability rules. To our knowledge, no court has addressed the question of medicolegal liability in cases involving injuries caused by relying on AI-generated information [26]. As such, the entire medicolegal liability rests with the physician, regardless of what AI suggestions were used. The lack of legal liability and precedents may be because any GAI output is a by-product of a pool of stakeholders: developers, users, and Internet training data [1].

An example illustrating the need for increased medicolegal regulation is in digital health app domain, which is increasingly incorporating GAI models. The potential for automation of GAI models offers the opportunity for scale, which may increase accessibility. However, apps can be inconsistent in incorporating principles of validated psychotherapeutic modalities, oversight of this marketplace is limited, and few incentives exist for current mental health apps to share efficacy and safety data.

A resident who demonstrates ACGME-defined Professionalism also role models professional behavior and ethical principles and a CanMEDS Professional exhibits professional behavior in the use of technology-enabled communication. Institutions have made policies against the use of GAI by learners and faculty due to privacy, ethical, and academic integrity concerns, though this is largely self-monitored. While GAI content detectors have been developed to address plagiarism issues, they often erroneously flag instances of GAI use in human-written content and give rise to further privacy concerns if inputting student-generated work [27]. Nonetheless, GAI may modify traditional admissions practices, particularly rethinking the role of personal statements in applications.

Systems-Based Practice (ACGME)—Health Advocate (CanMEDS)

ACGME describes a role for psychiatrists to lead innovations and advocate for populations and communities with health care inequities and a CanMEDS Advocate responds to the health needs of the communities that they serve, such as identifying the determinants of mental health of the population, including barriers to access to care and resources. In AI, issues of bias and discrimination are vital to consider, particularly the potential for conscious or unconscious bias to be incorporated into AI algorithms. Furthermore, GAI systems are often "black boxes" in which its inner mechanisms may not even be known to the engineers who created them. Additionally, the data used in training GAI systems is not publicly known, although it is believed to contain public sources, such as PubMed or Wikipedia. This lack of transparency can further obscure the source of the bias.

These concerns have significant implications for education delivery and competency-based medical education assessment, such as with question writing, curricula teaching, learner progression, and determination of competency. To mitigate biases, data sampling from various geographic, cultural, and socioeconomic strata may be informative to improve the representation in data that GAI is trained on. The need to balance patient autonomy, confidentiality, and informed consent is important to consider as well.

Interpersonal Skills and Communication & Patient Care (ACGME)—Collaborator (CanMEDS)

An ACGME-competent psychiatry resident aims to identify complex barriers to effective communication and a CanMEDS Collaborator participates effectively and appropriately in an interprofessional health care team. AI-powered automatic speech recognition and transcription might help teach this skill. GAI also has the capability to convert raw spoken language into fluent, punctuated text, and make live lectures more accessible for hearing-impaired learners. Furthermore, GAI-powered language translation models for lectures and research articles can also lower barriers of global knowledge exchange and enable literature to be accessible to individuals of multi-lingual teams. Expanding the reach of cross-cultural collaboration can yield multilateral benefits, enriching insights into different clinical practices.

Systems-Based Practice (ACGME)—Leader (CanMEDS)

Psychiatrists are integral participants in health care organizations, as they organize sustainable practices, make decisions concerning the allocation of resources, and contribute to the effectiveness of the health care system (CanMEDS) and may analyze individual practice patterns and professional requirements in preparation for practice (ACGME). For instance, as assessment data, such as entrustment ratings and exam scores, are becoming digitized, integration

with GAI systems and learning analytics can become increasingly efficient. Beyond determining what data is captured, there is a practical concern about how the data is captured, especially concerning competency evaluation. The sensitivity of assessments necessitates careful consideration; miscoding or technological malfunctions could have adverse consequences for the learner. Moreover, educational institutions must invest in infrastructure and technological support, including data storage, secure networks, and computing hardware, to fully harness the benefits of GAI.

Lastly, as ACGME and CanMEDS aim for competency in employing information technology appropriately for patient care, the field is facing an ever-growing need for GAI model development and validation studies that include psychiatric education [28]. For example, a burgeoning area of research is optimizing and building literacy in prompt engineering to improve interactions with GAI. Another research gap is the lack of well-powered studies using GAI as educational tool as compared with traditional methods of teaching.

Conclusions

GAI possesses both opportunities and risks within psychiatric education as per ACGME Core Competencies (and associated Psychiatry Milestones) as well as RCPSC CanMEDS Roles (and associated Objectives of Training in Psychiatry). The potential harms of teaching inaccurate material are high in medicine. Despite the current shortcomings of GAI, its potential value in psychiatric education underscores the need for human expert oversight and feedback mechanisms to ensure responsible and robust use. Further research on systematically applying and validating GAI systems for psychiatric education and establishing GAI literacy are next steps in actualizing GAI's potential opportunities. This will allow stakeholders in psychiatry to be well-positioned in potentially implementing GAI into clinical training and advancing the competency of future generations of psychiatrists.

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References

1. Reznick RK, Harris K, Horsley T, Hassani MS. Task force report on artificial intelligence and emerging digital technologies. Royal College of Physicians and Surgeons of Canada; 2020.
2. American Medical Association. Report 4 of the council on medical education. Augmented intelligence in medical education. https://www.amaassn.org/system/files/cme-report-4-a19-annotated.pdf. Accessed 8 Sep 2024.
3. Franco D'Souza R, Amanullah S, Mathew M, Surapaneni KM. Appraising the performance of ChatGPT in psychiatry using 100 clinical case vignettes. Asian J Psychiatr. 2023;89:103770.
4. Randhawa J, Khan A. A conversation with ChatGPT about the usage of lithium in pregnancy for bipolar disorder. Cureus. 2023;15(10):e46548.
5. Galido PV, Butala S, Chakerian M, Agustines D. A case study demonstrating applications of ChatGPT in the clinical management of treatment-resistant schizophrenia. Cureus. 2023;15(4):e38166.
6. Royal College of Physicians and Surgeons of Canada. Objectives of training in the specialty of psychiatry. 2015. https://www.royalcollege.ca/content/dam/documents/ibd/psychiatry/psychiatry_otr_e.html. Accessed 8 Sep 2024.
7. Accreditation Council for Graduate Medical Education. Psychiatry milestones. 2020. https://www.acgme.org/globalassets/pdfs/milestones/psychiatrymilestones.pdf. Accessed 8 Sep 2024.
8. Kıyak YS, Emekli E. ChatGPT prompts for generating multiple-choice questions in medical education and evidence on their validity: a literature review. Postgrad Med J. 2024;100(1189):858–65.
9. Barnard F, Van Sittert M, Rambhatla S. Self-diagnosis and large language models: a new front for medical misinformation. arXiv. 2023;2307:04910.
10. Cahyawijaya S, Lee N, Dai W, Su D, Wilie B. A multitask, multilingual, multimodal evaluation of ChatGPT on reasoning, hallucination, and interactivity. arXiv. 2023;2302.04023.
11. Satariano A. E.U. agrees on landmark artificial intelligence rules. https://www.nytimes.com/2023/12/08/technology/eu-ai-act-regulation.html. Accessed 8 Sep 2024.
12. Bhayana R, Krishna S, Bleakney RR. Performance of ChatGPT on a radiology board-styleexamination: insights into current strengths and limitations. Radiology. 2023;307(5):e230582.
13. Cai LZ, Shaheen A, Jin A, Fukui R, Yi JS, Yannuzzi N, et al. Performance of generative large language models on ophthalmology board-style questions. Am J Ophthalmol. 2023;254:141–9.
14. Wang H, Wu W, Dou Z, He L, Yang L. Performance and exploration of ChatGPT in medical examination, records and education in Chinese: pave the way for medical AI. Int J Med Inform. 2023;177:105173.
15. Bhattacharyya M, Miller VM, Bhattacharyya D, Miller LE. High rates of fabricated and inaccurate references in ChatGPT-generated medical content. Cureus. 2023;15(5):e39238.

16. Singhal K, Azizi S, Tu T, Mahdavi SS, Wei J, Chung HW, et al. Large language models encode clinical knowledge. Nature. 2023;620(7972):172–80.
17. Accreditation Council for Graduate Medical Education. Child and adolescent psychiatry milestones. 2022. https://www.acgme.org/globalassets/pdfs/milestones/childandadolescentpsychiatrymilestones.pdf. Accessed 8 Sep 2024.
18. Scherr R, Halaseh FF, Spina A, Andalib S, Rivera R. ChatGPT Interactive medical simulations for early clinical education: case study. JMIR Med Educ. 2023;9:e49877.
19. Strachan JWA, Albergo D, Borghini G, Pansardi O, Scaliti E, Gupta S, et al. Testing theory of mind in large language models and humans. Nat Hum Behav. 2024;8:1285–95.
20. Nayak A, Alkaitis M, Nayak K, Nikolov M, Weinfurt K, Schulman K. Comparison of history of present illness summaries generated by a chatbot and senior internal medicine residents. JAMA Intern Med. 2023;183(9):1026–7.
21. Bibault JE, Chaix B, Guillemassé A, Cousin S, Escande A, Perrin M, et al. A chatbot versus physicians to provide information for patients with breast cancer: Blind, randomized controlled noninferiority trial. J Med Internet Res. 2019;21(11):e15787.
22. Ayers JW, Poliak A, Dredze M, Leas EC, Zhu Z, Kelley JB, et al. Comparing physician and artificial intelligence chatbot responses to patient questions posted to a public social media forum. JAMA Intern Med. 2023;183(6):589–96.
23. Thorbecke C. National Eating Disorders Association takes its AI chatbot offline after complaints of ' harmful ' advice. https://www.cnn.com/2023/06/01/tech/eating-disorderchatbot/index.html. Accessed 8 Sep 2024.
24. De Freitas J, Uguralp A, Uguralp Z, Puntoni S. The dark side of generative AI: chatbots and mental health. Harvard Business School. https://www.hbs.edu/faculty/Pages/item.aspx?num=65118. Accessed 8 Sep 2024.
25. Lee P, Goldberg C, Kohane I, Bubeck S. The AI revolution in medicine: GPT-4 and beyond. London, UK: Pearson Education, Inc.; 2023.
26. Duffourc M, Gerke S. Generative AI in health care and liability risks for physicians and safety concerns for patients. JAMA. 2023;330(4):313–4.
27. Kwon D. AI is complicating plagiarism. How should scientists respond? Nature. 2024. https://doi.org/10.1038/d41586-024-02371-z.
28. Masters K, Salcedo D. A checklist for reporting, reading and evaluating Artificial Intelligence Technology Enhanced Learning (AITEL) research in medical education. Med Teach. 2024;46(9):1175–9.