Canadian Medical Education Journal
Revue canadienne de l'éducation médicale

Data-Informed Medicine in CanMEDS 2025
Médecine fondée sur les données dans CanMEDS 2025

Brent Thoma, P Alison Paprica, Padma Kaul, Warren J Cheung, Andrew K Hall et Ewan Affleck

Volume 14, numéro 1, 2023

CanMEDS 2025 Special Issue
Numéro spécial CanMEDS 2025

URI : https://id.erudit.org/iderudit/1099043ar
DOI : https://doi.org/10.36834/cmej.75440

Aller au sommaire du numéro

Éditeur(s)

Canadian Medical Education Journal

ISSN

1923-1202 (numérique)

Découvrir la revue

Citer ce document

Thoma, B., Paprica, P., Kaul, P., Cheung, W., Hall, A. & Affleck, E. (2023). Data-Informed Medicine in CanMEDS 2025. *Canadian Medical Education Journal / Revue canadienne de l'éducation médicale*, *14*(1), 54–57. https://doi.org/10.36834/cmej.75440

Canadian Medical Education Journal

Emerging Concepts

Data-Informed Medicine in CanMEDS 2025

Médecine fondée sur les données dans CanMEDS 2025

Brent Thoma,[1,2] P Alison Paprica,[3] Padma Kaul,[4,5] Warren J Cheung,[2,6] Andrew K Hall,[2,6] Ewan Affleck[7]

[1]University of Saskatchewan, Saskatchewan, Canada; [2]Royal College of Physicians and Surgeons of Canada, Ontario, Canada; [3]University of Toronto, Ontario, Canada; [4]University of Alberta, Alberta, Canada; [5]Canadian VIGOUR Centre, Alberta, Canada; [6]University of Ottawa, Ontario, Canada; [7]College of Physicians & Surgeons of Alberta, Alberta, Canada

Correspondence to: Dr. Ewan Affleck, College of Physicians and Surgeons of Alberta, 2700 10020 100 Street NW Edmonton, Alberta, T5J 0N3 Canada.

Published ahead of issue: Oct 17, 2022; published Mar 21, 2023. CMEJ 2023, 14(1) Available at https://doi.org/10.36834/cmej.75440

Introduction

The need for enhanced physician competency in the use of health data and information is broadly acknowledged. A recent review[1] Identified data-informed medicine as a concept that is underrepresented in the CanMEDS physician competency framework[2] and the Royal College "Task Force Report on Artificial Intelligence and Emerging Digital Technologies" recommended incorporating related competencies into CanMEDS.[3] Data-informed medicine relates to competencies required for the collection, use, and sharing of data and other digital information that is needed by physicians to deliver quality patient health service. This primer summarizes the concept of data-informed medicine and its links to former and future iterations of CanMEDS. The related concept of virtual care is addressed in another article in this issue.[4]

What is Data-Informed Medicine and why is it important to physician competency?

In much of modern society, analogue information processes have been replaced by digital workflows that are generating an abundance of data. This has been transformative for most sectors of society including travel, commerce, entertainment, politics, and social interaction. However, the health sector has been slow to harness the value proposition, and digital health data are underutilized despite being collected at an exponentially increasing rate. Rather than being intentional in the design of data architecture, our health data construct is frequently disorganized and occurs by happenstance as a byproduct of governance, public policy, or new technologies. A widespread lack of literacy about the foundational importance of evidence-based data architecture to quality health service underlies this approach.

The practice of medicine is evolving as individual and population-level health data change how medical decisions are made.[5] Moving forward, the medical profession will need to harness the power of data to develop learning health systems that routinely collect and analyze health data to generate knowledge to inform health decisions and/or system improvements.[6] The result will be the practice of data-informed medicine that incorporates the collection, exchange, aggregation, and analysis of health data to inform patient care and promote public good. Rather than replacing human cognition, data-informed medicine will require health providers to expertly leverage health data to optimize their practice.

To support this new paradigm of 'human *and* machine' *data cooperation* will require new physician competencies;[7,8] the collection, organization, storage, exchange, aggregation, and interpretation of health data to facilitate high-quality patient care. Ensuring that physician trainees are competent in these areas is challenging due to current variability in quality of health information systems and a shortfall of curricular content demonstrating the relationship between health data architecture, health data use, and the provision of quality health services. Despite calls for the meaningful integration of health data curriculum in undergraduate medical education[8] little tangible change has occurred, and a cohort of medical

professionals continues to be trained who lack basic health data competencies, and are expected to function in a fragmented digital technology and public policy environment. Further, the lack of data literacy and poorly integrated technology is contributing to physician burnout.[9] Equipping physicians with foundational health data literacy and expertise is essential to harness the potential of comprehensive digital health data to improve patient care and population health.

Herein, we suggest updates to CanMEDS to promote core competencies that will enable physicians to collect, exchange, aggregate, and analyze data to practice sound data-informed medicine (Table 1).

How is Data-Informed Medicine represented in the 2015 CanMEDS competency framework?

Data-informed medicine is not a term that is acknowledged in the 2015 CanMEDS competency framework.[2] Health informatics is mentioned under the Leader role (1.4), but it is not specifically defined. For the purposes of these proposed competencies, we utilize a definition adapted from the Medical Council of Canada, who define health informatics as "*the study of information [and data] design and use in health care.*"[10] In turn we propose the following definition of medical informatics: *"the application of health informatics knowledge by physicians to promote quality health services."* While the 2015 framework does mention the use of information under the medical expert, health advocate, and scholar roles, the many competencies required to optimize data-informed medicine are not explicit.

When considering the absence of this concept within the 2015 CanMEDS physician competency framework,[2] it is important to recognize the changes that have occurred in this field over the past decade, marked by an increased focus on health information exchange, health data equity, health data interoperability, and data analytics that have prompted an emphasis on the importance of data-informed medicine over recent years.

How can Data-Informed Medicine be better represented within the 2025 CanMEDS competency framework?

Underscoring the importance of new competencies to support data-informed medicine, the Royal College "Task Force Report on Artificial Intelligence and Emerging Digital Technologies" suggested that 'Digital Health Literacy' should be added as an eighth CanMEDS role.[3] However, we believe that competencies related to this concept (which are also addressed in a related article on virtual care[4]) should span existing CanMEDS roles. We therefore suggest modification of existing enabling competencies to include key elements of data-informed medicine, rather than the creation of a unique role.

Concepts that have been integrated include the collection and storage of patient data to facilitate its exchange, aggregation, analysis, and utilization in medical service; improving patient access to personal health information; and promoting the use of health data for individual and system performance improvement. To effectively integrate these competencies, a systematic reimagination of digital-age medical education is required that embraces a systemic and cultural shift in our approach to medical training and health service. Physicians are essential partners in the delivery of data-informed care. The data that their practices generate are essential to clinical care and health system planning, innovation, population health, and research. The competencies described in this paper are intended to ensure the capacity of physicians to contribute in a comprehensive, coordinated and patient-centered way as the opportunities and risks associated with health data grow.

Table 1. Data-informed medicine competencies for the CanMEDS Physician Competency Framework.

A. CanMEDS 2015 Competencies directly applicable to Data-Informed Medicine	
Leader 1.4 Use health informatics to improve the quality of patient care and optimize patient safety.	
B. CanMEDS 2015 Competencies partially related to Data-Informed Medicine	
Medical Expert 5.2 Adopt strategies that promote patient safety and address human and system factors Communicator 5.2 Communicate effectively using a written health record, electronic medical record, or other digital technology Communicator 5.3 Share information with patients and others in a manner that respects patient privacy and confidentiality and enhances understanding Scholar 1.2 Identify opportunities for learning and improvement by regularly reflecting on and assessing their performance using various internal and external data sources Scholar 1.3 Engage in collaborative learning to continuously improve personal practice and contribute to collective improvements in practice Health Advocate 1.3 Incorporate disease prevention, health promotion, and health surveillance into interactions with individual patients Health Advocate 2.2 Improve clinical practice by applying a process of continuous quality improvement to disease prevention, health promotion, and health surveillance activities	
C. Suggested additions or modifications for the CanMEDS 2025 Framework related to Data-Informed Medicine	
New or Modified Competency	*Rationale for change*
Medical Expert	
2.5 (New): Optimize through medical informatics expertise the use of individual and population-based health data in treatment and care.	Medical informatics expertise can provide physicians with essential tools to use health data to optimize the management of patients and populations.
Communicator	
3.3 (New): Use digital-age health data and tools to optimize communication with patients and caregivers on an individual and population basis.	Medical informatics expertise can render physicians competent to employ novel digital means to promote quality care through effective patient, public and inter-professional communication.
5.4 (New):Tailor communication tools and data to meet the needs and capacity of individual patients.	Not all patients will need or be able to engage with their health information in the same way. Physicians must adapt their communication to ensure that all patients understand their health information
5.5 (New): Ensure health data quality by capturing, recording, and retaining data in a way that facilitates its exchange, aggregation and analysis.	The architecture of health data has a major impact on how effectively it can be used for health service. Physicians must capture health data in a way that promotes its optimal use.
Collaborator	
3.3 (New). Ensure the effective exchange of health information across an individual's circle of care to optimize quality health outcomes.	Information that cannot be accessed is not helpful, and its inaccessibility puts the patient at risk. Physicians must ensure that those within the patient's circle of care are able to appropriately access the health information they require for patient care.
Leader	
1.4 (Modify): Use health data and medical informatics expertise to improve the quality of patient care and optimize patient safety.	As defined within this manuscript, medical informatics is a more appropriate term than health informatics to describe the application of health informatics in the professional domain of physicians.
1.5 (New): Facilitate the collection, exchange, analysis and aggregation of patient data to support health system improvement and public good.	How patient data are collected has implications for how they can be used. Physicians must ensure that the data they compile can be used to support system improvement.
Health Advocate	
1.4 (New): Ensure comprehensive and prompt patient access to personal health data, according to need.	Patients have a right to their data and physicians should promote its accessibility.
2.4 (New): Use data-driven evidence and medical informatics expertise in professional advocacy work.	Advocacy can be strengthened by using health data to demonstrate patient and population need.
Scholar	
1.2 (Modified): Identify opportunities for learning and improvement by regularly reflecting on and assessing one's performance using health data and medical informatics expertise	Data from medical informatics provide essential quantitative information that physicians need to optimize their practice.
Professional	
1.6 (New): Ensure that any exchange and/or use of patient data is secure, ethical, and lawful.	Personal health information is sensitive and must be protected from breaches of security and privacy within the context of data use and exchange.[11]

Conflicts of Interest: Dr. Brent Thoma has received payments for teaching, research, and administrative work from the University of Saskatchewan College of Medicine, payments for teaching and administrative work from the Royal College of Physicians and Surgeons of Canada, honoraria for teaching or writing from Harvard Medical School, the New England Journal of Medicine, the University of Cincinnati Children's Hospital, and NYC Health + Hospitals, and research grant funding from the Government of Ontario and the Canadian Association of Emergency Physicians. P. Alison Paprica receives funding from the Canadian Institute of Health Research and other provincial and national research funders. She is affiliated with the Institute for Health Policy, Management and Evaluation at the University of Toronto, ICES and Health Data Research Network Canada. Dr. Padma Kaul has received payments for teaching, research and administrative work from the University of Alberta. She holds a Canadian Institute of Health Research Chair in Sex and Gender Science and is supported by a Heart & Stroke Foundation Chair in Cardiovascular Research. Dr. Warren J. Cheung has received payments for teaching, research and administrative work from the University of Ottawa as well as payments for teaching and administrative work from the Royal College of Physicians and Surgeons of Canada. Dr. Andrew K. Hall has received payments for teaching, research and administrative work from the University of Ottawa and Queen's University, as well as payments for teaching and administrative work from the Royal College of Physicians and Surgeons of Canada. Ewan Affleck has received honoraria for work from the Auditor General of Ontario, The Canadian Medical Association, and Health Excellence Canada

Funding: This project was completed with logistical support from the Royal College of Physicians and Surgeons of Canada.

Acknowledgement: The authors would like to acknowledge Ms. Megan McComb for planning and logistical support.

References

1. Thoma B, Karwowska A, Samson L, et al. Emerging concepts in the CanMEDS physician competency framework. *Can Med Educ J.* 2023. https://doi.org/10.36834/cmej.75591
2. Frank JR, Snell L, Sherbino J Editors. *CanMEDs 2015 physician competency framework* [Internet]. 2015 p. 1–30. Available from: http://www.royalcollege.ca/portal/page/portal/rc/canmeds/resources/publications [Accessed on Oct 3, 2022].
3. Reznick RK, Harris K, Horsley T, Hassani MS, Council Task Force on Artificial Intelligence and Emerging Digital Technologies. Task Force Report on Artificial Intelligence and Emerging Digital Technologies [Internet]. Ottawa, ON: Royal College of Physicians and Surgeons of Canada; 2020 Feb p. 1–52. Available from: https://www.royalcollege.ca/rcsite/documents/health-policy/rc-ai-task-force-e.pdf
4. Stovel RG, Dubois D, Chan TM, Snell L, Thoma B, Ho K. Virtual Care in CanMEDS 2025. *Can Med Educ J.* 2023. https://doi.org/10.36834/cmej.75439
5. Ghassemi M, Goldenberg A, Morris Q, et al. Accessible data, health AI and the human right to benefit from science and its applications. *Health Law Can.* 2019 Aug 1;40:38.
6. Goel V, Affleck E, Dean S, et al. *Pan-Canadian Health Data Strategy: Toward a world-class health data system* [Internet]. Ottawa, Ontario: Public Health Agency of Canada; 2022 May. Report No.: 3. Available from: https://www.canada.ca/en/public-health/corporate/mandate/about-agency/external-advisory-bodies/list/pan-canadian-health-data-strategy-reports-summaries/expert-advisory-group-report-03-toward-world-class-health-data-system.html [Accessed on May 23, 2022].
7. Di leva A. AI-augmented multidisciplinary teams: hype or hope? *The Lancet*. 2019 Nov 16;394:1801.
8. Ellaway R, Hayward R, Ho K, Hurley K, Littleford J. *eHealth competencies for undergraduate medical educatio*n [Internet]. AFMC; 2014. Available from: https://www.ehealthresources.ca/sites/default/files/pdf/eHealth%20Competencies%20for%20UME.pdf [Accessed on Jul 20, 2022].
9. Yan Q, Jiang Z, Harbin Z, Tolbert PH, Davies MG. Exploring the relationship between electronic health records and provider burnout: a systematic review. *J Am Med Inform Assoc*. 2021 May 1;28(5):1009–21. https://doi.org/10.1093/jamia/ocab009
10. Medical Council of Canada. *Updates to the MCC objectives for the qualifying examination*. Ottawa, ON:; 2022 Mar p. 1–7. Available from: https://h5a9c8a9.stackpathcdn.com/media/MCCQE-Objectives-updates-2022.pdf [Accessed on May 11, 2022].
11. Desai T, Ritchie F, Welpton R. Five safes: designing data access for research. *Econ Work Pap Ser*. 1601:1–27.