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Canadian Medical Education Journal

Emerging Concepts

Complex adaptive systems in CanMEDS 2025

Systèmes adaptatifs complexes dans CanMEDS 2025

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Introduction

Complex Adaptive Systems are underrepresented in the CanMEDS physician competency framework.[1] As a concept, it relates to navigating and engaging with our complex health system in service of optimal health care outcomes for patients and populations,[2] starting with how healthcare teams function as complex adaptive systems.[3] This manuscript aims to summarize the concept and its links to current and future iterations of CanMEDS.

What are Complex Adaptive Systems and why are they important to physician competency?

Complexity is about rich interconnectivity whereby things interact in unexpected and irreversible ways. According to the WHO, "The health system consists of all interacting and interdependent components, such as organizations, people, and actions, whose primary intent is to promote, restore, and/or maintain health."[4] That aligns with the definition of a complex adaptive system: complex, implying diversity with a great number of non-linear connections between a wide variety of elements; adaptive, suggesting the capacity to learn from experience and change within a changing context; system, a set of interdependently connected agents.[5,6]

As historically designed, the Canadian healthcare system focuses on curing acute disease with in-hospital care.[7] As a result, hospitals and physician-mediated care have dominated the dialogue on our system's organization and funding. Resident physician training has been largely embedded in and framed by these structures. However, the determinants of health and management of disease are multilayered and interdependent subsystems that continuously interact and influence each other.[8] The boundaries of these systems are semipermeable. Their interconnectedness was demonstrated during the COVID syndemic as biologic and social conditions and states interacted to increase a person's susceptibility to harm or worsen their health outcomes.[9]

While each physician may not be able to influence all elements of the health system (as for example, food security, housing, education, climate change, home care, child development, inequity, etc.), physicians need to understand this ecosystem in order to make choices about how they will engage with their patients and other agents within this system. This requires a foundational understanding of systems and their influence on organizational structure and culture, emphasizing the importance of diversity of perspective, acting within the boundaries of a clear and shared purpose, and creating spaces for continuous adaptation to, and learning from emergent changes in the environment.[10]

Building on this understanding, physicians need to develop the skills to engage all stakeholders, find and trigger systemic high leverage (tipping) points, and be aware of concepts like unintended consequences and system structures. Finally, physicians need to possess the attitudes and skills to accept and deal with rapid, unpredictable, paradoxical, and tangled situations and thoughtfully manage their behaviours, and own wellness.

How are Complex Adaptive Systems represented in the 2015 CanMEDS competency framework?

One of the major changes in the 2015 CanMEDS Physician Competency Framework was the modification of the 'Manager' role to the 'Leader' role.[11] This change was made to bring greater focus on physicians' role in quality improvement and resource stewardship throughout complex health systems. Two of the key competencies added to the role of Leader (1 and 3) contributed most to the skills needed to function in complex systems.

The second Health Advocate key competency also touches on systems thinking[11] as it connects the elements of the acute healthcare system upstream, not only with those of primary and preventive care, but also with other factors that affect health and wellness and require advocacy. Finally, the role of Collaborator has a few elements that link with systems thinking, including concepts like "transitions of care" and "collaborations with community providers."[11]

How can Complex Adaptive Systems be better represented within the 2025 CanMEDS competency framework?

A recent comparison of CanMEDS with the LEADS leadership framework found that CanMEDS competencies pay substantial attention to some of the domains focused on the care of individual patients (lead self, engage others, and achieve results), but less attention to broader competencies related to Complex Adaptive Systems (develop coalitions and systems transformation).[12] The frequent systemic disruptions that have occurred over the past several years, particularly in response to the COVID-19 pandemic have demonstrated the need for a greater understanding of complex adaptive systems by all physicians.[13] Competencies in this area will help physicians to see themselves as active participants in the transformation of the healthcare system and may have contributed to this concept being identified as one which needs to be fleshed out further in CanMEDS 2025.

The changes that we propose to better incorporate Complex Adaptive Systems in CanMEDS 2025 are outlined in Table 1. Within the Leader role, the proposed modifications would increase the focus on complexity-informed leadership paradigms alongside quality improvement that promote greater support for innovation, emergence and understanding of the complex interactions between patient-specific and system-wide decisions.[14] Under Collaborator, we propose more explicitly acknowledging the need for diversity and differences of perspective when making complex decisions as well as broadening the notion of who is a collaborator beyond the patient and family. For Health Advocate, we make suggestions that would acknowledge the complex interactions between patients and the social determinants of health. Lastly, under Scholar we suggest including competencies that require the incorporation of elements of social learning theory into the design and delivery of educational activities.

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Table 1. Complex Adaptive Systems Competencies for the CanMEDS Physician Competency Framework.

A. CanMEDS 2015 Competencies directly applicable to Complex Adaptive Systems	
Leader 1. Contribute to the improvement of health care delivery in teams, organizations, and systems Leader 1.1 Apply the science of quality improvement to contribute to improving systems of patient care Leader 1.2 Contribute to a culture that promotes patient safety Leader 1.3 Analyze patient safety incidents to enhance systems of care Leader 1.4 Use health informatics to improve the quality of patient care and optimize patient safety Leader 3. Demonstrate leadership in professional practice Leader 3.1 Demonstrate leadership skills to enhance health care Leader 3.2 Facilitate change in health care to enhance services and outcomes	
B. CanMEDS 2015 Competencies partially related to Complex Adaptive Systems	
Health Advocate 2. Respond to the needs of the communities or populations they serve by advocating with them for system-level change in a socially accountable manner Health Advocate 2.1 Work with a community or population to identify the determinants of health that affect them Health Advocate 2.2 Improve clinical practice by applying a process of continuous quality improvement to disease prevention, health promotion, and health surveillance activities Health Advocate 2.3 Contribute to a process to improve health in the community or population they serve	
Collaborator 1 Work effectively with physicians and other colleagues in the health care professions Collaborator 1.1 Establish and maintain positive relationships with physicians and other colleagues in the health care professions to support relationship-centred collaborative care Collaborator 1.2 Negotiate overlapping and shared responsibilities with physicians and other colleagues in the health care professions in episodic and ongoing care Collaborator 1.3 Engage in respectful shared decision-making with physicians and other colleagues in the health care professions Collaborator 2 Work with physicians and other colleagues in the health care professions to promote understanding, manage differences, and resolve conflicts Collaborator 2.1 Show respect toward collaborators Collaborator 2.2 Implement strategies to promote understanding, manage differences, and resolve conflicts in a manner that supports a collaborative culture	
C. Suggested additions or modifications for the CanMEDS 2025 Framework related to Complex Adaptive Systems	
New or Modified Competency	*Rationale for change*
Collaborator	
1 (Modified) Work effectively with physicians and co-workers in the health care **system**	Work within complex adaptive systems requires engagement with a wide variety of stakeholders - including those who may not be healthcare professionals. These suggestions reflect this by referring broadly to collaborators as co-workers within the health care system.
1.1 (Modified) Establish and maintain positive relationships with physicians and **co-workers** in the health care **system** to support relationship-centred collaborative care	
1.2 (Modified) Negotiate overlapping and shared responsibilities with physicians and **co-workers** in the health care **system** in episodic and ongoing care	
1.3 (Modified) Engage in respectful shared decision-making with physicians and other coworkers in the health care **system**	
2.2 (Modified): Implement strategies to promote understanding, **value differences, and engage in generative conflict in a manner that supports a culture of safety, collaboration, learning and accountability**	Differences of opinion should not be looked at as something to 'manage', but should be sought out as a valued opportunity to build understanding between collaborators with different perspectives. Active listening and engaging a diversity of perspectives enables the discovery of novel (or generative) solutions and supports the development of a positive culture.
2.3 (NEW) Seek out and engage relevant stakeholders with the diversity of perspectives needed to address complex issues	Openly promoting safe and equitable inclusion enhances diversity of contribution and the emergence of innovation while providing the perspectives needed to generate novel solutions in complex environments.
2.4 (NEW) Promote equity in the workplace through supportive relationships and public acts of advocacy and sponsorship	
Leader	
1.1 (Modified): Apply the science of quality improvement **and complexity thinking** to contribute to the improvement of health systems	Despite the complexity of the healthcare system, the system lens is often neglected to focus on individual patient safety and quality improvement in a siloed way. Physicians need to understand complexity for these initiatives to be effective, including polarity management and decision-making in clear, complicated, complex, and sometimes chaotic systems.
1.4 (Modified): **Use technology and health informatics to optimize the quality and safety of patient care**	The interplay between technology, healthcare professionals and communities of practice allows the system to learn together and to adapt to unforeseen circumstances.[16] Technology from outside of healthcare is frequently used.
1.5 (New): Utilize systems thinking to identify and support the implementation of changes that improve patient care and the health system.	Systems thinking should be used when considering the intended and unintended impact of new initiatives.
3.3 (NEW): Engage others in the co-creation and design of organizational systems that support a culture of safety, collaboration, learning and accountability	Culture cannot be changed directly, but it can be enhanced by engaging in co-creation with diverse co-workers Demonstrating this competency effectively requires acknowledgement of the privileged position that physicians are in, the interdependence of their work with others work, and the need for the engagement of others in this process.
3,4 (New) Manage ambiguity, uncertainty and polarities encountered in the complexity of health and healthcare systems.	Physicians must be able to manage working within an ambiguous, uncertain, and polarizing system.
Scholar	
1.4 (NEW) Engage in educational activities with co-workers to effect change in complex adaptive systems	Education undertaken with co-workers from different specialties, professions, or departments in the workplace is essential to understand complex issues, non-linear connections, the impact on the system, and to identify ground-up solutions. Physicians need to engage equitably and collaboratively in these activities.[15]
2.7 (NEW): Use social learning principles in the design and delivery of educational activities to distribute participation, promote engagement, and co-create meaning.	Educational activities that include all stakeholders engaging their uncertainties result in the co-creation of meaning and are more likely to result in improvement in complex environments.[15,16]

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