

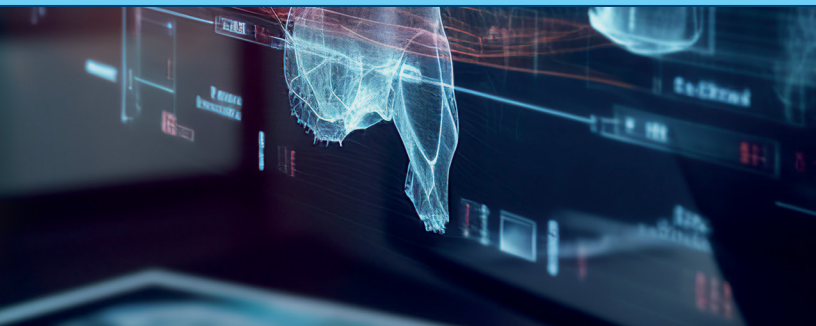


Guidebook on the Competency Framework for Artificial Intelligence in Healthcare

FOSTERING THE ADOPTION OF AI
FOR THE BENEFIT OF PATIENTS



SCHOOL OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE (SAIH)
Centre hospitalier de l'Université de Montréal (CHUM)



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MESSAGE FROM THE CHIEF LEARNING OFFICER

We are witnessing a time of rapid transformation in the field of healthcare. On the one hand, medical and scientific advancements have led to the development of new treatments and medications for diseases once considered incurable. On the other hand, our aging population's healthcare needs are continuously evolving and intensifying. To keep up, the healthcare sector must constantly adapt to these changes. But in a context where the healthcare and social services network is facing an unprecedented labour shortage, how do we pick up the pace and act faster than disease?

The development of new technologies such as artificial intelligence (AI) presents a glimmer of hope. Integrating such technologies into practice in a way that is beneficial to patients does, however, present a major challenge. To meet this challenge head on, we must commit to continuous transformation. We must support individuals, teams, and our healthcare system in their ability to adopt innovative technologies. It is with this perspective that we have created this *Guidebook on the Competency Framework for Artificial Intelligence in Healthcare*.

This Guidebook is so much more than a simple compilation of competencies to be acquired or developed. It serves as a fundamental cornerstone to direct our actions towards a future of progress and excellence. We take pride in having assembled a dedicated team and the collective expertise of specialists to successfully carry out this ambitious initiative.

Together, we have forged a path of innovation. The CHUM School of Artificial Intelligence in Healthcare (SAIH) was the first to emphasize the development of human skills to integrate AI ethically and responsibly into the healthcare field. In doing so, we are laying the foundation for AI and human competencies to seamlessly integrate, ensuring that we effectively meet the population's needs.

We firmly believe that this Guidebook will be a valuable ally for your future in the healthcare sector. Together, let us continue to move forward towards a future where innovation and compassion intersect to transform our healthcare system.

Sincerely,



Nathalie Beaulieu
Chief Learning Officer
Centre hospitalier de l'Université de Montréal (CHUM)



LEADERS

FROM THE LOCAL AND INTERNATIONAL AI ECOSYSTEM

“Artificial Intelligence offers significant promise to health and care services globally, but to unlock its effective use, the workforce must be prepared to work effectively with it. It is important, as healthcare workers, that we own its use as a technology, ease its embedding into our workflows, and allow it to augment our services. I support this competency framework as an example of best practice and encourage its uptake amongst educators, learners, employers and educational institutions.”

Dr Hatim Abdulhussein

CEO Health Innovation Kent Surrey Sussex
Chief Officer NHS Health Innovation Network
Former National Clinical Lead for AI and Digital Workforce at NHS England

“Some technical skills are now well managed by AI systems, providing functional and mathematical responses based on vast data sets. Other skills, such as moral imagination, critical thinking, discernment, and professional judgment, require responsibility, consideration of ethical issues, and intuition that surpass the current capabilities of algorithmic systems. AI is therefore a complementary tool that can assist professionals in their human decision-making but AI cannot perceive or understand the world as a human does.”

Lyse Langlois

Executive Director
The International Observatory on the Societal Impacts
of AI and Digital Technologies

“It is always risky to predict the future of medical practices... However, with the Competency Framework for Artificial Intelligence in Healthcare of the SAIH, one thing is certain: all healthcare professionals are involved. It is imperative, starting today, to acquire new skills to embrace the range of AI tools in healthcare. This is not a revolution, but a true re-evolution of medicine!”

Professor Pierre-Antoine Gourraud

Head of the Data Clinic
Université de Nantes and CHU de Nantes, France

“This unique framework of the SAIH goes well beyond technology. It allows healthcare professionals to feel supported and equipped to navigate the transformations in their field. By supporting the humans behind these innovations, we truly advance our society.”

Anne Nguyen

Chief AI Officer
Conseil de l'innovation du Québec

“The CHUM School of Artificial Intelligence in Healthcare is a powerful driver of the AI ecosystem in Quebec. With its Competency Framework Guidebook, it is redefining healthcare practices while paving the way for innovations applicable in other sectors. This type of leadership is what propels all of Quebec forward.”

Luc Sirois

Chief Innovator of Quebec
Conseil de l'innovation du Québec

ACKNOWLEDGMENTS

This Guidebook represents a significant step forward in the continuous improvement of health-care services provided at the *Centre hospitalier de l'Université de Montréal* (CHUM). Its ultimate goal is to address the needs of healthcare professionals, patients, and the broader community.

We extend our heartfelt thanks to our partners who supported the implementation of this project. Initiated by the School of Artificial Intelligence in Healthcare (SAIH), the project brought together over thirty experts (see appendix) from healthcare, artificial intelligence (AI), education, research, and entrepreneurship sectors. Their mandate: to identify and prioritize the key competencies required to foster the integration of AI to better serve patients.

To the clinicians, researchers, educators, and industry specialists involved, we wish to acknowledge your invaluable contributions to this monumental process. Your collective insights have driven and inspired us to push our work further. Without your interdisciplinary collaboration, this model would not have achieved its remarkable breadth and precision. Your contributions highlighted the significance of both human and technical competencies, enabled the emergence of the model's innovative structure, and ensured its strong alignment with industry needs and its applicability to healthcare.

This Guidebook is the culmination of several years of analysis, research, discussions, and development focused on future competencies in healthcare. It was made possible through the financial support of the Quebec *ministère de l'Économie, de l'Innovation et de l'Énergie* through its No-vaScience program. This program supports the implementation of innovative strategies and tools that contribute to the development of competencies to accelerate AI integration in healthcare.

Finally, we extend our deepest gratitude to all stakeholders who contributed to this Guidebook, whether directly or indirectly. Their participation, collaborative spirit, and commitment were instrumental in making its deployment possible.

Sincerely,

The Editorial Team



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FORWARD

In 2020, the *Centre hospitalier de l'Université de Montréal* (CHUM) School of Artificial Intelligence in Healthcare (SAIH) launched its *Competency Framework for Artificial Intelligence in Healthcare* (see page 16). This initiative aimed to address the lack of tools available for training in artificial intelligence (AI). Healthcare actors often did not know where to start, which competencies to prioritize, or how to improve them. Consequently, it became essential to develop complementary tools to facilitate the development of key competencies to integrate AI into their practice.

The primary objective of this Guidebook is to promote the understanding and use of the *Competency Framework for Artificial Intelligence in Healthcare* from a perspective of continuous professional development and training. This Guidebook is divided into 4 main sections. The first section introduces our organization, how work is transformed through AI, and the importance of implementing a competency framework to support healthcare actors in this transformation. The second section outlines the methodology of the framework, while the third section outlines its logical model. The fourth and final section lays out the framework's competencies, presents their definitions and key elements (highlights), and provides examples of practical applications.

This Guidebook is intended to all healthcare actors, that is anyone who has a stake in improving healthcare services, including:

- Healthcare and service teams
- Interns, externs, and resident physicians
- Physicians
- Researchers
- Managers and professionals
- Patients and the general population
- Other partners in the healthcare sector

GLOSSARY

The following definitions apply to this document.

Andragogy: The science and practice of adult education in a professional context.

Artificial Intelligence (AI): A discipline and method to reproduce a certain level of intelligence by computer to simulate (digitally represent) a real-world phenomenon or situation.

Competency Framework: A tool to catalogue and organize a set of necessary competencies within a given context. In this Guidebook, the context is to promote better integration of AI in healthcare.

Continuous Professional Development: The process by which an individual actively seeks the best ways to improve their practice within their profession.

Cross-functional Competencies: The knowledge, hard skills (technical competencies), and soft skills also known as “power skills” (behavioural and interpersonal competencies) mastered by various professions and applicable in different professional situations.

Digital Transformation: An approach aiming at deeply changing an organization by integrating digital technologies, such as AI, into all its administrative processes, communications, and activities, by redesigning its business model and adapting its organizational culture to new digital realities.

Framework Category (or Quadrant): One of four families of competencies within this framework that share similar orientations, more specifically: relational competencies, reflective competencies, self-oriented competencies and action-oriented competencies.

Framework Level (or Layer): One of four groups of competencies within this framework that are similar in nature and lend themselves to common learning strategies, more specifically: mindsets, human competencies, specific competencies, and human-AI interface competencies.

Future Skills: A set of knowledge, know-how, and attitudes necessary for practising professions in the coming years. Frameworks using the term future skills “are based not on an analysis of current competency needs but on the anticipation of new competencies that will be required in the near future” [translation] (Hart, 2019).

Healthcare Actor: An individual involved in the healthcare system, including patients, members of care or service teams, students, resident physicians, physicians, researchers, managers, healthcare professionals, health sector partners, and more.

Learner: An individual engaged in the development of their competencies.

Technical Competencies: Specialized competencies, skills, or professional know-how as opposed to behavioural or interpersonal competencies.



I. ABOUT US

The **Centre hospitalier de l'Université de Montréal (CHUM)** stands as one of the foremost academic healthcare institutions in North America. It is recognized as one of Canada's most advanced hospitals, leading the transformation of healthcare services that benefit patients, hospital employees, and the Quebec population at large. Central to its mission is education—a crucial tool to address the significant challenges in the healthcare sector.

The CHUM at a glance:

- 500,000 patients
- 3.8 million people in its service area
- 19,000 healthcare professionals, including over 5,000 passionate interns, externs, and resident physicians dedicated to the future of healthcare

The **Direction de l'enseignement et de l'Académie CHUM (DEAC)** is committed to creating value through teaching and learning. Its mission is to help healthcare actors develop the ability to create and integrate knowledge and innovations in real-world settings to improve public healthcare. The DEAC strives to provide an enriching, engaging, and human learning experience within the CHUM. The DEAC is renowned for its pioneering work and expertise in training, simulation, library science, and learning innovation. It represents a dynamic ecosystem of healthcare and education experts working to improve public health. The DEAC collaborates closely with the *Université de Montréal*, over 280 educational institutions, and more than 85 other partners. This dynamic department has also established one of the largest learning and simulation centres in North America.

In 2018, the DEAC launched the world's first **School of Artificial Intelligence in Healthcare (SAIH)**, focusing on developing human capabilities and implementing AI in real healthcare settings. The SAIH's mission is to support healthcare actors in integrating AI ethically and responsibly to benefit patients. Since its inception, the SAIH has developed more than 100 educational activities and tools with more than 100 AI and healthcare specialists. Its awareness and training activities have attracted over 45,000 participants.

II. IN WHAT CONTEXT IS THE COMPETENCY FRAMEWORK APPLIED?

AI advancements are driving the transformation of work. In the healthcare sector, it presents a promising avenue for improving prevention, diagnostics, and care, as well as for optimizing processes. Many healthcare organizations such as the CHUM are increasingly integrating digital technologies—including AI—to better personalize care and increase their ability to meet the population's evolving needs.

In recent years, many specialists have recognized the importance of raising awareness among healthcare professionals regarding current and future digital transformations and providing them with adequate training ([Royal College of Physicians and Surgeons of Canada, 2020](#); [Topol Review, 2019](#)). To prepare for the future, it is imperative to lay out, in clear and concrete terms, the competencies that will be essential to support these transformations. This preliminary step will guide the continuous development of competencies throughout healthcare professionals' careers to account for the growing impact of AI on their evolving professional responsibilities.

It is now recognized ([Sage-Gavin, Vazirani, and Hintermann, 2019](#); [Gobeil-Proulx, 2021](#)) that the integration of AI requires more than just technical competencies. A set of fundamentally human competencies is also necessary to foster the responsible and sustainable uptake of these technologies.



III. WHAT IS THE ROLE OF THE COMPETENCY FRAMEWORK IN THE SUCCESSFUL IMPLEMENTATION OF AI IN HEALTHCARE?

The *Competency Framework for Artificial Intelligence in Healthcare* is primarily intended for two groups of actors within the healthcare network: those seeking AI-related continuous professional development and those entrusted with training responsibilities. For the former group, the Framework helps them zero-in on learning activities that best meet their training objectives in a work context. For the latter, it helps guide the development of these training activities.

The Framework is the foundation upon which all SAIH learning activities are built. On a larger scale, it is also the cornerstone of its training program, thus fulfilling a dual role. On the one hand, it serves as a reference framework, and on the other, it facilitates the creation or selection of educational materials tailored to learners.

For AI to be successfully used in the healthcare sector, new competencies must be acquired. As such, it is crucial to prepare both groups mentioned above by guiding them through various stages, from awareness to training. To this end, a competency framework is an ideal tool, as it facilitates the identification and organization of competencies needed for the integration of AI or other major transformations.

The *Conseil interprofessionnel du Québec* (CIQ), which comprises the province's 46 professional orders, understands this reality. In its December 2021 report, the CIQ emphasized the importance of guiding digital transformation among its various professional orders by providing adequate training. It suggests that Quebec's professional system can benefit from a competency framework—such as the CHUM's *Competency Framework for Artificial Intelligence in Healthcare*—and illustrates the relevance of relying on such tools to structure training activities (CIQ, 2021).

Moreover, recent scientific and gray literature abounds with discussions about future competencies (World Economic Forum, 2023; Conference Board of Canada, 2020, UNESCO, 2023). They reference competencies that are extremely useful now, and even more so in the next 10 years. Competencies, such as collaboration, creative thinking, and problem-solving. Our work therefore aligns with research on the transformation of work, professions, and roles, which is inseparable from the notion of transforming healthcare through AI.

In this context, the *Competency Framework for Artificial Intelligence in Healthcare* is indispensable for developing the essential competencies needed to accelerate the integration of AI into the healthcare sector.

PART 2: METHODOLOGY

The *Competency Framework for Artificial Intelligence in Healthcare* is the culmination of 18 months of research, including analysis, development, and validation. It was developed through a consultative process involving collaboration with experts in andragogy, AI specialists, as well as healthcare professionals, and patients.

The selection and conceptualization of these competencies were based on data gathered and synthesized from a variety of sources, including:

- Over 30 specialists;
- Over 200 scientific and professional publications;
- An external benchmarking process involving approximately twenty comparable frameworks;
- Responses to a survey from approximately 100 learners at the SAIH.

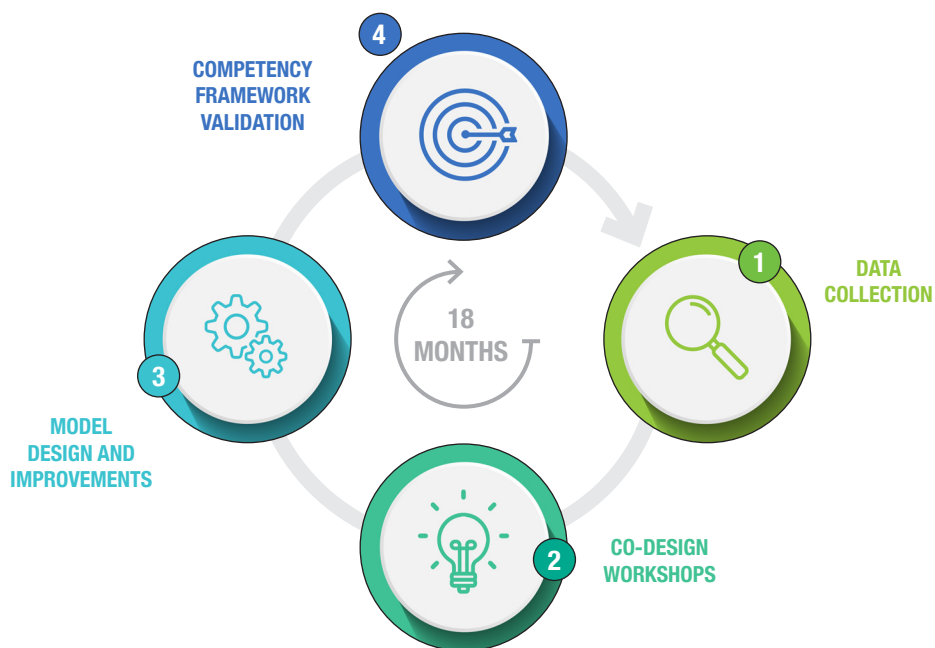


Figure 1. A Rigorous Development Process

The development of the *Competency Framework for Artificial Intelligence in Healthcare* began with a thorough analysis of existing work referencing best practices in competency models and key concepts related to AI (Batt et al., 2019; LeBoterf, 2018; Campion et al., 2011; Tardif, 2006). This initial phase was followed by an in-depth review of external organizational reports on trends in AI competencies or broader digital age skills, with a specific focus on healthcare-related publications.

Through a series of co-design workshops, experts from the AI, healthcare, and educational sectors came together to identify ongoing professional development needs related to AI integration. Then, both internal and external specialists from the CHUM participated in iterative consultation rounds to refine and enhance multiple versions of the model.

These analyses guided the project team in selecting, structuring, defining, and visually representing the competencies.

Field observations as well as interviews with team facilitators supporting AI projects at the CHUM underscored the relevance of emerging competencies. An additional round of literature review further solidified the proposed concepts and their applicability to other healthcare organizations.

While various competency frameworks for specific healthcare professions already exist, none focus on transdisciplinary competencies centred on AI integration. Thus, a decision was made to propose a framework encompassing diverse competencies, independent of job titles, for cross-functional application within healthcare organizations. This model allows for the selection of specific competencies to create tailored profiles. It should be noted that this framework was designed to evolve over time – by adding and refining layers and competencies – as AI transforms healthcare.

Methodology: Development Milestones

The following chart outlines the Framework's key development milestones.

- 2018** — Launch of the CHUM's School of Artificial Intelligence in Healthcare (SAIH)
- 2019** — Co-design Phase
— Start of the development and validation rounds for the *Competency Framework for Artificial Intelligence in Healthcare*
- 2020** — Graphical modelling
— Dissemination on the SAIH website and gradual launch
— Increased awareness of its relevance to the future of healthcare (beyond the integration of AI)
- 2021** — Series of public presentations (ongoing)
— Updates
- 2022** — New webpage for the Competency Framework
— First range of tools become available
- 2023** — Grant from Quebec's *ministère de l'Économie, de l'Innovation et de l'Énergie* to create new awareness and competency development tools
— Beta version of the *Guidebook on the Competency Framework for Artificial Intelligence in Healthcare* tested with users (French version)
— Updates and adjustments based on feedback
- 2024** — Publication of the *Guidebook on the Competency Framework for Artificial Intelligence in Healthcare*
— Dissemination of new awareness and development tools to support field teams

I. COMPETENCY FRAMEWORK

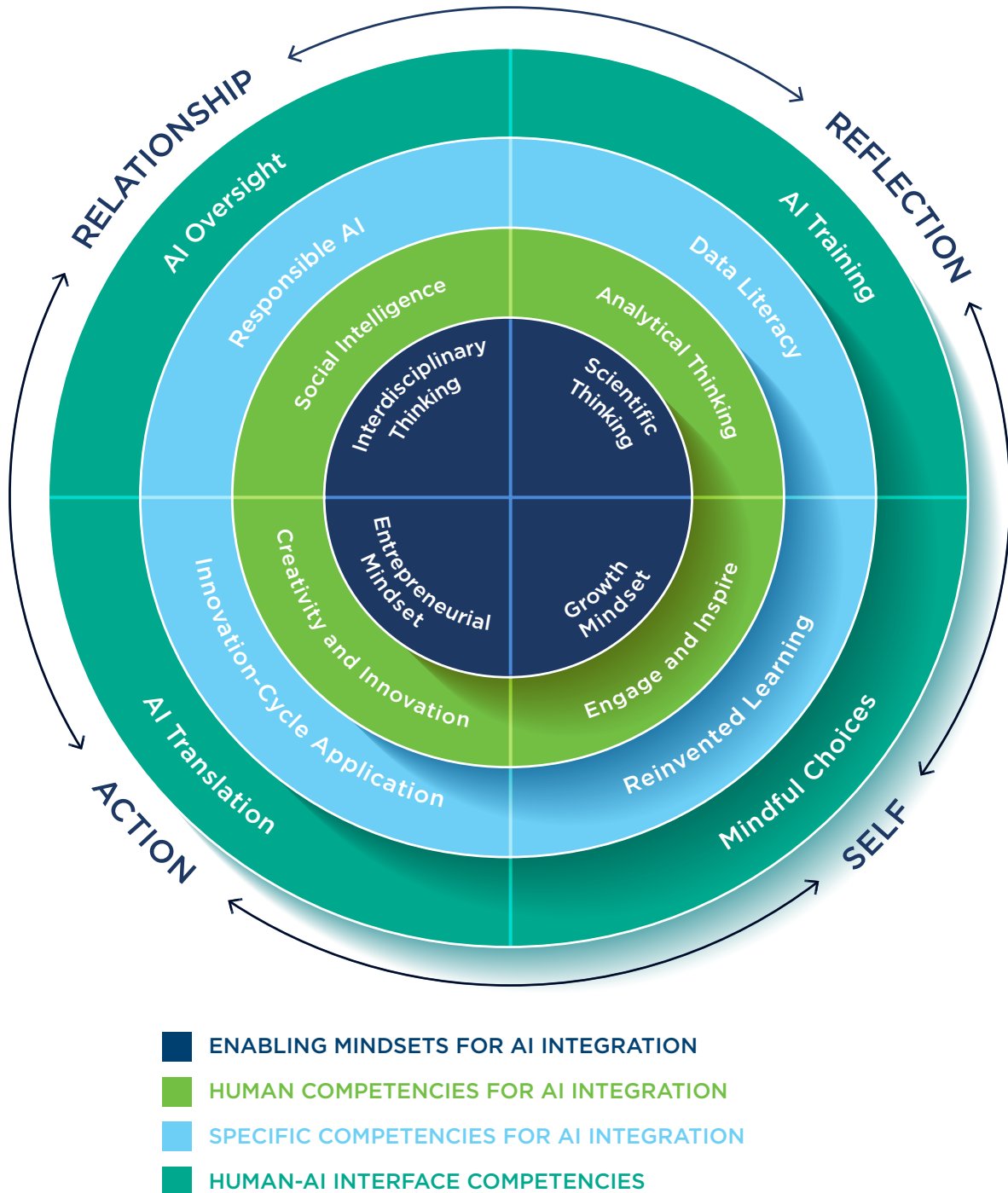


Figure 2. The *Competency Framework for Artificial Intelligence in Healthcare*, which includes 16 competencies and 4 layers, each represented by a different colour.

II. ANATOMY OF A COMPETENCY

The following definition of “competency” has been selected to guide the concept of this framework and its components: *“a complex know-how, based on the effective mobilization and use of a variety of internal and external resources within a family of situations”* [translation] (Tardif, 2006).

The Framework is made up of 16 distinct competencies, each presented as follows:

- Competency name: a name that evokes the targeted concept.
- Competency definition: a general description of the competency and its mastery.
- Competency key elements: the distinct elements—typically 3 per competency—required for competency mastery.



III. BIAXIAL STRUCTURE

The Framework's structure was specifically designed to maximize its practicality rather than just providing a list of competencies. Its biaxial structure makes it possible to align multiple layers, to divide the model into quadrants, and to position each of the framework's competencies.

More concretely, the Framework consists of **4 quadrants** divided by **2 perpendicular axes**. Each of the Framework's **16 competencies** then falls into one of **4 categories** (quadrants):

- **Relational** competencies
- **Reflective** competencies
- **Self-oriented** competencies
- **Action-oriented** competencies

Relational competencies are used during our social interactions and in our dealings with others in a work context. **Reflective** competencies are conceptual and cognitive in nature; they involve ideas and leverage human capacity for reflective and analytical thinking. **Self-oriented** competencies draw upon our personal resources. Finally, **action-oriented** competencies focus on achieving results.

Additionally, the model includes **4 levels of competencies**, illustrated by layers of different colours.

The first and centremost layer focuses on competencies that relate to **mindsets**. Adopting these competencies is essential to foster changes that impact work culture, including digital transformations. These competencies are also essential for developing greater agility in adopting AI. They form the foundation for building the competencies of the next layer.

The second layer focuses on fundamental **human competencies** that need to be emphasized in work settings where some tasks are supported or enhanced by AI. These personal and social competencies are generally recognized as those of the future ([Observatoire compétences-emplois \[OCE\], 2019](#)).

The third layer focuses on **AI-specific competencies** that should be mastered over time, but that will be easier to develop once a certain foundational level of competencies has been acquired. These technical skills and knowledge will make it easier for healthcare professionals to navigate a world in which data, algorithms, and AI play an increasingly important role.

The fourth and outermost layer focuses on **human-AI interface competencies** that only come into play once teams start interacting with AI. They represent the various roles that need to be mastered once AI is implemented to continue effectively using it over time.

How to Read the Framework

The model's biaxial structure allows learners to easily navigate the framework based on the nature of the competencies to be developed and acquired. On one hand, the quadrants intuitively group competencies according to their primary orientation (relational, reflective, self, action). On the other hand, the stackable layers encompass 4 related competencies that are acquired and refined through similar learning strategies. Competencies build on each other, so moving through each quadrant – from its core to its outermost layer – helps learners identify adjacent competencies that support talent development. For instance, an entrepreneurial mindset can help learners develop the next competency layer, i.e. creativity and innovation.

- The quadrants (categories) should be read in a clockwise direction starting from the top-left *Relational* quadrant (Figure 4);
- The layers (levels) should be read from the core outward (Figure 3).

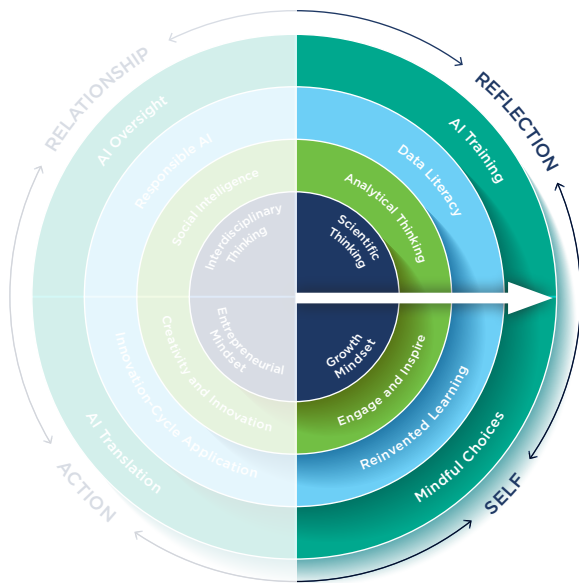


Figure 3. From the core outward

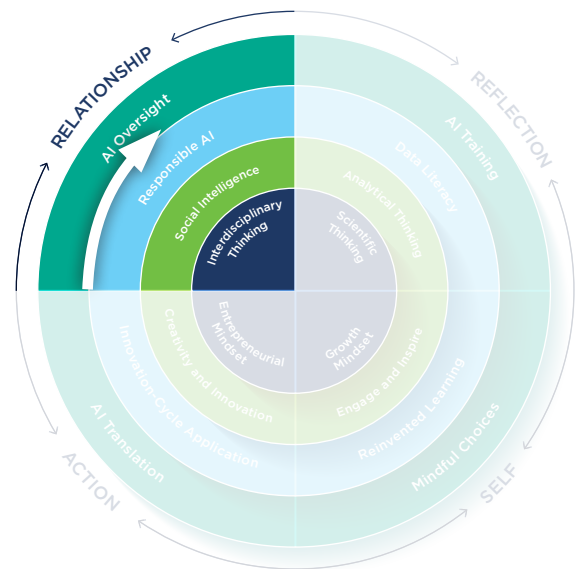


Figure 4. Clockwise starting from the *Relational* quadrant

IV. LOGICAL MODEL

Each of the 16 competencies is associated with 3 key elements (i.e., target behaviours) that must be demonstrated for the competency to be mastered. These key elements are accompanied by practical examples of how each target behaviour can be applied. This design means that the competency model can be used at 2 different levels or depths. Accordingly, learners can choose to acquire or develop the competencies at:

- A *macro* level by focusing on the 16 competencies and their definitions; or
- A *micro* level by focusing on the competencies' 48 key elements.

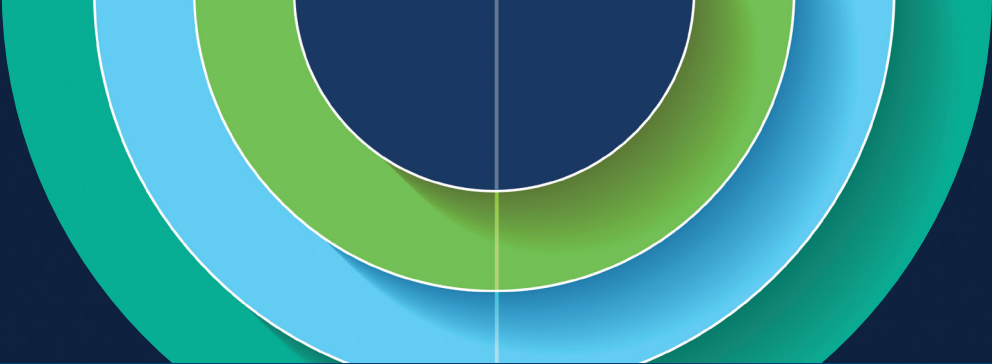
Here is an example of how this translates for the *Human Competencies* layer (level) within the *Relational* quadrant (category) (see the table below and Figure 4).

Competency	Definition	Key Elements	Examples of Applications
Social Intelligence	Responding to the needs of others in a manner appropriate to the situation by using verbal and non-verbal skills	> Paying attention to others through listening and observation > Showing empathy > Adopting a caring behaviour	> Listening and responding patiently to questions > Taking the concerns of others into consideration > Personalizing interventions to meet unique patient needs

Ultimately, the *Competency Framework for Artificial Intelligence in Healthcare* stands out from other frameworks due to the following aspects:

- Emphasis on **cross-functional and fundamental competencies** applicable across healthcare functions;
- Hierarchical organization of concepts along **2 axes**, as opposed to a list of competencies;
- Integration of both **general** and technical competencies;
- Consultation with experts in **education, training, and AI**;
- Incorporation of theoretical concepts from **andragogy, psychology** and **management**, to facilitate change and adaptation;
- **Evolving** nature to support digital transformation;
- **Intersectoral** and **interdisciplinary** perspectives built into its design.





MINDSETS

A significant portion of failures in organizational transformation can often be attributed to managers' oversight in adequately addressing mindsets (Fountaine, McCarthy, & Saleh, 2019). We regard these mindsets as foundational competencies underpinning the transformations brought about by AI. They equip individuals to enhance their adaptability and resilience.



ENABLING MINDSETS FOR AI INTEGRATION

Name and Definition	Key Elements	Examples of Applications
Interdisciplinary and Intersectoral Thinking Adopting collaborative reflexes by integrating a diverse range of people into the search for better problem-solving and shared decision-making	> Including different perspectives and approaches > Engaging in exchanges to reach a higher common interest > Considering the interdependencies between groups and the impacts of decisions on one another	> Solving increasingly complex problems as a team > Collaborating on an AI project with a group of people with diverse competencies > Combining perspectives from scientists across various sectors, disciplines, and demographics
Scientific Thinking Basing decisions on verifiable facts after fully understanding the situation	> Seeking relevant information to strengthen thinking and knowledge > Distinguishing between true and false information > Adopting a critical attitude towards information	> Exercising one's role as an informed citizen > Demonstrating scientific rigour and critical thinking in one's reasoning > Basing decisions on evidence > Performing validation steps
Growth Mindset Continuously improving by adjusting one's behaviour to the new demands of one's environment	> Showing openness to feedback, change, and development > Pushing one's limits by making efforts to strengthen one's abilities and potential > Approaching challenges as opportunities to learn	> Developing oneself every day by investing effort > Learning from one's own actions > Learning how to learn and how to handle the exponential amount of information
Entrepreneurial Mindset Seeking and seizing opportunities with significant impacts by recognizing their potential and accepting their share of risks	> Being on the lookout for potential opportunities > Daring to move forward despite the risks > Accepting an iterative, incremental, and adaptive development cycle	> Seizing improvement opportunities by daring to experiment for better outcomes > Showing boldness by approaching new or recurring problems differently > Starting a new AI project



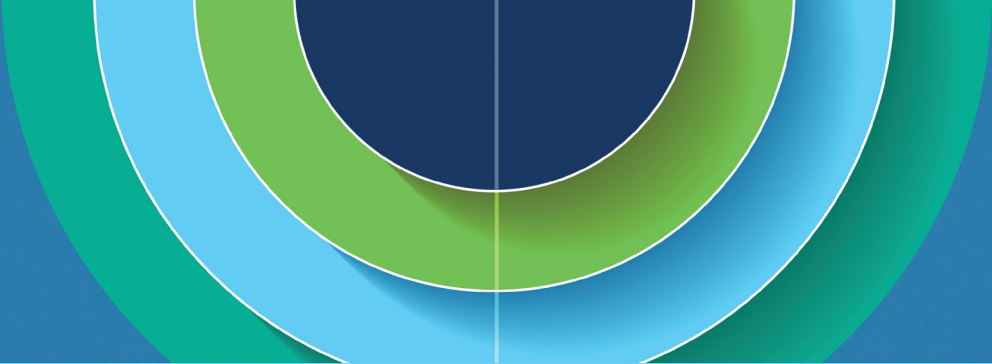
HUMAN COMPETENCIES

AI integration requires certain human competencies that are well known today but that should intensify in the coming years. A closer collaboration between humans and AI, where contributions from both intertwine, will render some tasks less useful and others more essential than ever. These competencies represent areas where humans currently surpass machines.



HUMAN COMPETENCIES FOR AI INTEGRATION

Name and Definition	Key Elements	Examples of Applications
Social Intelligence Responding to the needs of others in a manner appropriate to the situation by using verbal and non-verbal skills	> Paying attention to others through listening and observation > Showing empathy > Adopting a caring behaviour	> Listening and responding patiently to questions > Taking the concerns of others into consideration > Personalizing interventions to meet unique patient needs
Analytical Thinking Understanding complex issues and concepts from multiple perspectives by recognizing logical connections between different pieces of information	> Gathering information from multiple sources > Establishing associations between the information > Making informed decisions regarding a given situation	> Drawing informed conclusions from essential information > Addressing issues at source once cause-and-effect relationships are established > Integrating complex information sources
Engage and Inspire Encouraging others to embrace change by providing direction, purpose, momentum, and by generating enthusiasm for it	> Sharing a clear and meaningful vision > Strengthening healthcare actors' commitment to transformation > Encouraging individual accountability	> Motivating the team throughout transformations > Mobilizing everyone within projects > Communicating the importance of contributions
Creativity and Innovation Finding new or improved ways of doing things through the development, integration, evaluation, and sharing of ideas	> Encouraging the development of creative ideas > Transforming an idea into a viable solution that delivers value > Facilitating the implementation of changes in methodologies	> Identifying innovative solutions from a new perspective > Thinking outside the box and the usual way of doing things > Facilitating the adoption of all things new



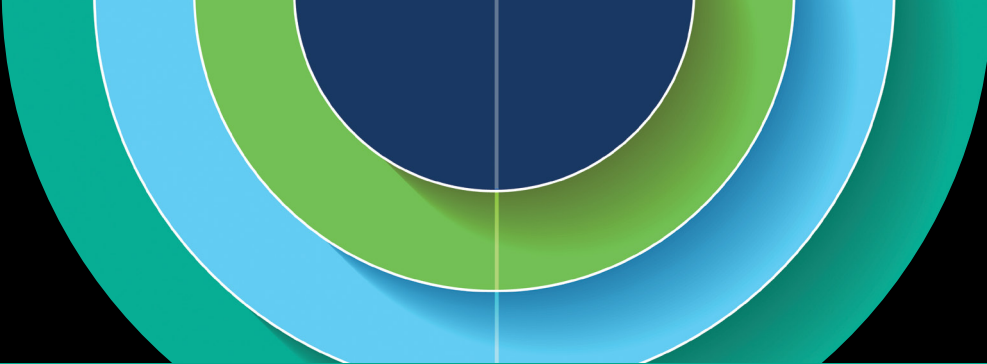
SPECIFIC COMPETENCIES

Unlike the previously discussed competencies, which are generally well known, those outlined in this section are relatively new in the talent development landscape. They are likely to become more prominent as AI solutions are increasingly integrated into health-care. Furthermore, entirely new areas of technical knowledge will need to be mastered.



SPECIFIC COMPETENCIES FOR AI INTEGRATION

Name and Definition	Key Elements	Examples of Applications
Responsible AI Considering the ethical issues and societal values underpinning the use of AI-based systems in healthcare for the benefit of humans	> Anticipating situations that may pose ethical and deontological issues > Contributing to collective reflection to address ethical problems > Acting with consideration for the consequences on safety and well-being	> Asking the right questions to anticipate the impacts of AI > Considering inclusion, transparency, and justice from the outset > Discussing potential human repercussions
Data Literacy Understanding the concepts, functioning, and relevance of AI in problem-solving through the ability to read, interpret, and use data	> Qualifying and manipulating collected or available data > Interpreting and explaining results > Experimenting with developing algorithms	> Using data within one's sector > Knowing the basics of AI > Demystifying the practical applications of AI
Reinvented Learning Engaging in continuous lifelong learning to adapt to the transformations brought about by AI	> Understanding the potential and scope of AI on one's work and development needs > Actively seeking learning opportunities by leveraging new learning methods > Quickly applying new learnings	> Staying informed about AI-induced changes in one's role > Adapting to these changes through lifelong learning > Taking accountability for updating one's knowledge and competencies
Innovation-Cycle Application Transforming an innovative AI-based idea into a concrete project by utilizing and adapting available processes and tools	> Identifying a relevant problem to solve with the help of AI > Researching and developing the AI-based solution > Experimenting with and implementing the solution, then measuring its impacts to ensure sustainability	> Implementing innovations involving AI > Managing AI-based projects > Utilizing available methodologies, tools, and processes



HUMAN-AI INTERFACE COMPETENCIES

This section is both emergent and predictive, and its content will become more concrete as interactions with AI systems in professional contexts increase. The new partnership connecting humans and AI in the workplace requires careful thought to properly anticipate tomorrow's competencies. These competencies could in fact correspond to new roles that may emerge in the healthcare sector.

HUMAN-AI INTERFACE COMPETENCIES

Name and Definition	Key Elements	Examples of Applications
AI Oversight Ensuring ongoing monitoring of the trustworthy use of AI-based systems	> Ensuring the social acceptability of AI-based systems by verifying results > Identifying potentially undesirable and unanticipated impacts on human conditions and the living world > Avoiding potential deviations by immediately intervening	> Maintaining socially responsible and irreproachable use of AI-based solutions over time > Monitoring results obtained by AI systems > Reacting to the slightest doubt
AI Training Participating in the development and refinement of AI-based systems	> Training algorithms in the use data sets > Teaching algorithms how to incorporate certain human components > Combining intelligences and learning from AI-based systems	> Acquiring advanced knowledge in data science > Refining AI solutions > Making the use of AI systems as natural as possible
Mindful Choices Making deliberate and thoughtful professional interventions based on one's competencies, knowledge, and expertise	> Reflecting on decisions to be made > Acting based on one's judgment > Taking responsibility for one's actions	> Maintaining control over work processes > Consulting AI systems as a complement to one's personal judgment > Prioritizing one's professional conscience
AI Translation Combining expertise from data science and field experience to facilitate the implementation of AI-based systems tailored to needs	> Simplifying data science knowledge for non-experts > Contextualizing data based on industry knowledge > Identifying obstacles and challenges related to the adoption of AI systems by field teams or organization	> Highlighting potential issues and obstacles in AI system implementation > Facilitating mutual understanding between participants from different expertise areas > Explaining or simplifying key elements of AI systems to field teams > Integrating field experience in the development and contextualization of the data obtained

CONCLUSION

Transformative technologies such as AI will continue to profoundly change how work is performed in the healthcare sector. The gradual integration of AI into all healthcare activities will require ongoing upskilling and reskilling for all healthcare professionals. For example, they will need to continuously learn to use these technologies, consider their impacts, adapt to new working conditions, and develop personal and relational competencies.

Tools designed to guide this upskilling are essential to support healthcare professionals. This Guidebook helps clarify the competencies that will be beneficial to master in the coming years. It also guides ongoing professional development efforts. To ensure a successful integration of AI, technical competencies must be supported by a combination of human abilities and favourable mindsets.

The framework presented here is intended to evolve over time, allowing for continuous improvement as digital transformations unfold within organizations. This Guidebook lays the essential groundwork for understanding and using the *Competency Framework for AI in Healthcare*. It aims to serve as a reference document for those dedicated to the successful implementation of AI in healthcare, both locally and globally.

We invite you to join the conversation if you, like us, are passionate about the future of work in healthcare and the best ways to prepare for it. Not only is healthcare evolving, but learning must also be reimaged in a digital context that requires teaching and learning *about* AI, *through* AI, and *with* AI.

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APPENDIX

LIST OF SPECIALISTS WHO CONTRIBUTED TO THE DEVELOPMENT OF THE FRAMEWORK

Project Team

The Competency Framework would not have been possible without the hard work and collaboration of an exceptional team at the CHUM.

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