

# Healthcare AI: A Quebec Framework for Nursing Education

March 2022

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## Preamble

Artificial intelligence (AI) technologies continue to expand exponentially in all sectors of our lives. The practice of nursing will be significantly impacted as AI technologies are put in place to perform specific nursing tasks. This will potentially affect how nurses provide patient care. “Nursing experience, knowledge, and skills will transition to learning new ways of thinking about and processing information – the nurse will become the information integrator, health coach, and deliverer of human caring, supported by AI technologies, not replaced by them” (Brenick, 2018).

This project (2020-2022) considers the ethical and social challenges of integrating AI within the practice of nursing with the goal to develop competencies for integration in nursing curricula to reflect this evolution in practice.

**McGill University's** Teaching and Learning Services (TLS), the Ingram School of Nursing (ISoN), and **John Abbott College's** (JAC) Department of Nursing formed a partnership to define competencies to support the introduction and application of AI tools within nursing practice.

### Of particular note:

- 1) The nursing education levels of proficiency used are based on the McGill curriculum and programs in ISoN [<https://www.mcgill.ca/nursing/programs>].
- 2) Post-secondary education in Quebec is comprised of CEGEP and university-level programs. Students have several options to pursue entry to practice:
  - A. 3-year CEGEP RN degree program
  - B. 3-year Bachelor of Science (Nursing) BSc(N)
  - C. 2-year Bachelor of Nursing Integrated (BNI) for licensed RNs (part of the Integrated continuum of studies from the CEGEP 3-year program)

### Funding acknowledgment:

This project received financial support from the *Pôle Montréalais d'enseignement supérieur en intelligence artificielle* (PIA) 2020-2022

## Competency 1 (Theory)

Statement of the Competency	Achievement Context
<p>Students will be able to apply knowledge of informatics and digital health technology to the practice of nursing.</p>	<ul style="list-style-type: none"> <li>▪ Within the legal framework of professional practice</li> <li>▪ Referring to current health policies and concepts</li> <li>▪ In order to promote and maintain health and prevent illness</li> <li>▪ In collaboration with health system facilities, associations, organizations, or institutions</li> <li>▪ In conjunction with clients in the health sector and the community</li> <li>▪ According to the therapeutic nursing plan, if applicable</li> <li>▪ Based on: – teaching programs – health programs – PIQ (Québec immunization protocol) – Québec priorities in public health – rules in effect in the health care institution – teaching materials</li> <li>▪ In accordance with: – the code of ethics – current legislation – approach to primary health care</li> </ul>

Elements of the Competency	Performance Criteria
<ol style="list-style-type: none"> <li>1. Electronic health records</li> <li>2. Electronic medical records</li> <li>3. Telehealth</li> <li>4. Smart medical devices</li> <li>5. Health applications</li> </ol>	<ol style="list-style-type: none"> <li>A. Summarize the uses of digital health technology and the digitization of electronic health records.</li> <li>B. Explain the fundamentals of telehealth, smart medical devices, and health applications as they impact nursing care.</li> </ol>

Performance criteria	Nursing education levels of proficiency (1 - Introduce; 2 - Reinforce; 3 - Master; 4 - Expert)					Cross-reference (CASN & DEC 180A0)	
	CEGEP	Undergraduate		Graduate	Specialization	CASN Domains	180A0 Competencies
	RN	BSc(N)	BNI	Master's	PhD		
<b>A</b>	1	1-2	2	3	-	1	
<b>B</b>	1	1-2	2	3	-	1	01Q0; 01QE; 01QH; 01QJ; 01QL; 01QM

### CROSS-REFERENCE TABLE

CASN Domains	180A0 Competencies
<p>1. Knowledge: The theoretical, conceptual, and factual content that is taught and learned in the programs.</p>	<p>01Q0: To analyze the work function            01QE: To intervene with hospitalized adults and elderly clients requiring medical/surgical nursing.            01QH: To intervene with clients requiring nursing care in a perinatal setting.            01QJ: To intervene with children and adolescents requiring nursing care.            01QL: To intervene with children and adolescents requiring nursing care.            01QM: To intervene with adults and elderly clients experiencing loss of autonomy who require institutional nursing.</p>

## Competency 2 (Theory)

### Statement of the Competency

Students will be able to apply their understanding of AI application and the inherent benefits and limitations.

### Achievement Context

- Within the legal framework of professional practice
- Referring to current health policies and concepts
- In order to promote and maintain health and prevent illness
- In collaboration with health system facilities, associations, organizations, or institutions
- In conjunction with clients in the health sector and the community
- According to the therapeutic nursing plan, if applicable
- Based on: – teaching programs – health programs – PIQ (Québec immunization protocol) – Québec priorities in public health – rules in effect in the health care institution – teaching materials
- Using: – measurement tools and devices – reference materials
- In accordance with: – the code of ethics – current legislation – approach to primary health care

### Elements of the Competency

1. Analysis of AI-generated information
2. How AI technology works
3. AI and the nursing process

### Performance Criteria

- A. Describe how AI compiles data from data sources and generates results.
- B. Identify potential areas where data bias can occur.
- C. Reflect on how AI impacts and contributes to the nursing process.

Performance criteria	Nursing education levels of proficiency (1 - Introduce; 2 - Reinforce; 3 - Master; 4 – Expert)					Cross-reference (CASN & DEC 180A0)	
	CEGEP	Undergraduate		Graduate	Specialization	CASN Domains	180AO Competencies
	RN	BSc(N)	BNI	Master's	PhD		
A	1	1-2	2	3	4	1	01Q1; 01Q7; 01Q8; 01Q9;
B	1	1-2	2	3	4	2	01QE; 01QG; 01QH; 01QJ;
C	1	1-2	2	3	4	2	01QL; 01QM

### CROSS-REFERENCE TABLE

#### CASN Domains

#### 180A0 Competencies

**1. Knowledge:** The theoretical, conceptual, and factual content that

**01Q1:** To develop an integrated perception of the human body and its functions.

<p>is taught and learned in the programs.</p> <p><b>2. Research, Methodologies, Critical Inquiry &amp; Evidence:</b> The thinking and the inquiry skills, and the processes used to appraise, generate, synthesize, translate, and implement knowledge.</p>	<p><b>01Q7:</b> To link immunological disorders and infections to physiological and metabolic mechanisms.</p> <p><b>01Q8:</b> To interpret a clinical situation by referring to health problems and other problems related to the field of nursing.</p> <p><b>01Q9:</b> To establish links between pharmacotherapy and a clinical situation.</p> <p><b>01QE:</b> To intervene with hospitalized adults and elderly clients requiring medical/surgical nursing.</p> <p><b>01QG:</b> To apply emergency measures.</p> <p><b>01QH:</b> To intervene with clients requiring nursing care in a perinatal setting.</p> <p><b>01QJ:</b> To intervene with children and adolescents requiring nursing care.</p> <p><b>01QL:</b> To intervene with children and adolescents requiring nursing care.</p> <p><b>01QM:</b> To intervene with adults and elderly clients experiencing loss of autonomy who require institutional nursing.</p>
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## Competency 3 (Practice)

### Statement of the Competency

Students will be able to apply AI tools within the nursing practice.

### Achievement Context

- Within the legal framework of professional practice
- Referring to current health policies and concepts
- In order to promote and maintain health and prevent illness
- In collaboration with health system facilities, associations, and organizations
- In conjunction with clients in the health sector and the community
- According to the therapeutic nursing plan, if applicable
- Based on: – teaching programs – health programs – PIQ (Québec immunization protocol) – Québec priorities in public health – rules in effect in the health care institution – teaching materials
- Using: – measurement tools and devices – reference materials
- In accordance with: – the code of ethics – current legislation – approach to primary health care
- Using language suited to the client

### Elements of the Competency

1. Application of AI-generated information
2. Patient education
3. Interprofessional communication
4. Nurse education
5. Multidisciplinary collaboration on AI projects within nursing practice.

### Performance Criteria

- A. Use AI tools within a clinical setting.
- B. Decide how results will be used to deliver safe patient care, following the nursing process/clinical reasoning.
- C. Discuss AI tools and results with patient, family, and other healthcare professionals.
- D. Lead the development and integration of AI in nursing practice using a multidisciplinary approach.

Performance criteria

**Nursing education levels of proficiency**  
(1 - Introduce; 2 - Reinforce; 3 - Master; 4 - Expert)

**Cross-reference**  
(CASN & DEC 180A0)

	CEGEP	Undergraduate		Graduate	Specialization	CASN Domains	180AO Competencies
	RN	BSc(N)	BNI	Master's	PhD		
A	1	1-2	2	3	-	3	01Q2; 01Q3; 01Q4; 01Q5; 01QA; 01QB; 01QD
B	1	1-2	2	3	4	2,3	
C	1	1-2	2	3	-	4	
D	-	-	-	3*	4	6	

\*Students will have acquired levels of proficiency 1 and 2 within the aforementioned competencies as part of the nursing curriculum and basic nursing program.

### CROSS-REFERENCE TABLE

CASN Domains	180AO Competencies
<p><b>2. Research, Methodologies, Critical Inquiry &amp; Evidence:</b> The thinking and the inquiry skills, and the processes used to appraise, generate, synthesize, translate, and implement knowledge.</p> <p><b>3. Nursing Practice:</b> The exercise of activities of a broad range of nursing roles that involve direct nursing care and/or indirect nursing care.</p> <p><b>4. Communication &amp; Collaboration:</b> The interaction and relationships between the nurse and clients, the nurse and other members of the health care team, and the nurse and key stakeholders.</p> <p><b>6. Leadership:</b> Process of social influence which maximize the efforts of others towards the achievement of goals or tasks.</p>	<p><b>01Q2:</b> To deal with a client's reactions and behaviours.</p> <p><b>01Q3:</b> To refer to a conceptual nursing framework, define one's professional practice.</p> <p><b>01Q4:</b> To use assessment and nursing care procedures.</p> <p><b>01Q5:</b> To establish a helping communication with the client and significant others.</p> <p><b>01QA:</b> To teach the client and his/her significant others.</p> <p><b>01QB:</b> To assist clients in the maintenance and improvement of their health.</p> <p><b>01QD:</b> To establish a cooperative relationship with members of the interdisciplinary team.</p>

### Competency 4 (Practice)

#### Statement of the Competency

Students will be able to participate in the development of AI guidelines in terms of ethical, social, and legal considerations (I.e., OIIQ).

#### Achievement Context

- Referring to the current organization of the health and social services system
- Based on laws, regulations, standards, and codes currently in effect
- Based on the: – policies and practice standards set by the OIIQ – nurses' ethical and legal obligations – Charter of Human Rights and Freedoms
- Within the legal framework of professional practice

## Elements of the Competency

## Performance Criteria

- |   |   |
|---|---|
| <p>1. Patient privacy and confidentiality</p> <p>2. Ethical, social, and legal considerations of AI</p> | <p>A. Analyse the ethical, social, and legal challenges of AI in terms of privacy and security of patient data.</p> <p>B. Identify potential areas where AI guidelines can be further developed.</p> <p>C. Advocate for stronger nursing involvement in AI development.</p> |
|---|---|

Performance criteria	Nursing education levels of proficiency (1 - Introduce; 2 - Reinforce; 3 - Master; 4 - Expert)					Cross-reference (CASN & DEC 180A0)	
	CEGEP	Undergraduate		Graduate	Specialization	CASN Domains	180AO Competencies
	RN	BSc(N)	BNI	Master's	PhD		
A	1	1-2	2	3	4	2	01Q6; 01QC; 01QF
B	-	1	1	2-3	4	2, 3	
C	-	1-2	1-2	3	4	6	

### CROSS-REFERENCE TABLE

#### CASN Domains

#### 180A0 Competencies

<p><b>2. Research, Methodologies, Critical Inquiry &amp; Evidence:</b> The thinking and the inquiry skills, and the processes used to appraise, generate, synthesize, translate, and implement knowledge.</p> <p><b>3. Nursing Practice:</b> The exercise of activities of a broad range of nursing roles that involve direct nursing care and/or indirect nursing care.</p> <p><b>6. Leadership:</b> Process of social influence which maximize the efforts of others towards the achievement of goals or tasks.</p>	<p><b>01Q6:</b> To deal with social and cultural realities related to health matters.</p> <p><b>01QC:</b> To adapt to various work situations.</p> <p><b>01QF:</b> To use the ethics and values of the profession to understand one's own role.</p>
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## Competency 5 (Practice)

### Statement of the Competency

Students will be able to engage in the development of AI training to support continuing nurse education.

### Achievement Context

- Within the current organization of the health and social service system in Quebec.
- Taking into account the requirements and development of professional practice
- With the help of professional resources, if appropriate
- Based on laws, regulations, standards, and codes currently in effect
- Based on information on public or private health institutions • Using recent data on the profession

### Elements of the Competency

1. Continuing nursing education

### Performance Criteria (Definition)

A. Develop AI training materials and activities for nurses to support continuing nurse education.

Performance criteria	Nursing education levels of proficiency (1 - Introduce; 2 - Reinforce; 3 - Master; 4 - Expert)					Cross-reference (CASN & DEC 180A0)	
	CEGEP	Undergraduate		Graduate	Specialization	CASN Domains	180AO Competencies
	RN	BSc(N)	BNI	Master's	PhD		
A	-	-	-	3*	4	6	-

\*Students will have acquired levels of proficiency 1 and 2 within the aforementioned competencies as part of the nursing curriculum and basic nursing program.

### CROSS-REFERENCE TABLE

CASN Domains	180AO Competencies
<p><b>6. Leadership:</b> Process of social influence which maximize the efforts of others towards the achievement of goals or tasks.</p>	<p>The current basic program does not address this level of competency.</p>

In Quebec, nurses are required to complete 20 hours per year of continuing nursing education (i.e., 7 accredited hours and 13 non-accredited hours) to maintain their professional license.

Source: <https://www.oiiq.org/en/la-competence-professionnelle-une-obligation-deontologique>

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## Glossary

### A

**Algorithm** A method or set of guidelines for making calculations, solving problems, or executing specific tasks, especially by a computer. Common examples include decision trees, linear regression, or logistic regression<sup>1</sup>.

**Artificial Intelligence (AI)** A series of methods which enable a machine to imitate the human process of learning, making predictions, making decisions, and being aware of its surroundings<sup>2</sup>. Examples of AI-based systems include speech and face recognition, smart assistants, search engines, advanced robotics, or Internet of Things applications.

### B

**Big Data** Large data sets that contain greater variety and more complex data sets from new data sources are analysed computationally to determine patterns, trends, or associations between human behaviour and interactions<sup>3</sup>.

### D

**Data Bias** When data is unrepresentative of the general population, resulting in an error in which certain features of a dataset are more represented than others and carry a greater weight<sup>4</sup>.

**Deep Learning (DL)** A branch of AI that is based on deep neural networks that mimic the way the human brain processes data, learns, and creates patterns to make decisions. Common examples include virtual assistants, face recognition, speech recognition, computer vision, and natural language processing<sup>1</sup>.

**Digital Health Application** The use of information and communication technology to deliver health care services and promote health while managing patients medical conditions or risk factors<sup>5</sup>.

### E

**Electronic Health Record (EMR)** The electronic collection and storing of patient health data across different healthcare practices and clinical settings through networks that store information<sup>1</sup>. Electronic medical record (EMR) tends to be used interchangeably with EHR, however, EMR is a digital version of a patient's chart containing the patient's medical and treatment history from one practice, rather than from multiple doctors or practices<sup>7</sup>.

**Ethics** Code of morals and the specific moral choices practiced based on the guiding values that govern an individual's behavior and actions<sup>8</sup>.

**Ethics of Artificial Intelligence** The ethics of artificial intelligence comprises a set of values, principles, and standards which employ a moral conduct of humans in the design and integration of AI, as well as the moral behavior of the AI technologies that have been deployed<sup>1</sup>.

I

**Internet of Things (IoT)** The network of connected objects through the internet that use embedded sensors that allow for machines to transfer and collect large quantities of data which can be analyzed by computer-based systems<sup>1</sup>.

M

**Machine Learning (ML)** A branch of AI in which algorithms have the ability to learn from data and experience, improving their accuracy over time, and then provide predictions or make decisions without being explicitly programmed to do so<sup>1</sup>.

N

**Natural Language Processing (NLP)** A computational process to analyze and comprehend unstructured data, and produce human languages based on that data, enabling communication with a computer. NLP includes speech recognition, machine translation, information retrieval, and artificial intelligence<sup>1</sup>.

**Neural Network** A computer system modelled on the human brain, specifically the connections between neurons, designed to stimulate the way the human brain processes, analyzes, and stores information to solve problems<sup>9</sup>.

**Nursing Process** A step-by-step approach to assess and care for patients, used as a tool to aid nurses in maintaining coherent and strategic management in patient care. The stages are used cyclically and repeatedly during care and include initial assessment, nursing diagnosis, planning, intervention and reassessment<sup>10</sup>.

S

**Smart Medical Devices** An electronic device that can connect and interact with other devices or networks to collect patient data, relay it to the patient's physician, and integrate it into electronic health records<sup>11</sup>.

T

**Telehealth** The delivery and facilitation of health and health-related services including medical care, patient education, and health information services<sup>12</sup>.

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