



Artificial Intelligence in Health Professions Education

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VANDERBILT
School of Nursing



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Disclosures

- Research discussed in this presentation was funded as part of an artificial intelligence research collaboration between Vanderbilt University Medical Center and IBM Watson Health.
- Dr. Russell received 10% effort from VUMC-IBM collaborative through a research grant (PI: Miller) funded from 2020-21 to study competencies needed for the use of artificial intelligence tools by clinicians.
- [Whatever happened to IBM Watson Health?](#) (New York Times July 2021).
- Graphics by Adobe Firefly Image Generator



Learning Objectives

1. Describe the expanding influence of artificial intelligence-based technologies in broader society, health care systems, and health professions education.
2. Review proposed competencies for the use of artificial intelligence-based tools by clinicians.





Outline

1. Foundations and Futures
2. Collaborative Research
3. Competencies for the Use of AI-based Tools by Health Professionals
4. Role of Educators and Education Systems

Education is necessary for responsible use of AI-based tools in the health professions.





Foundations & Futures



Bonnie Miller MD MMHC



Foundations:

Competency-Based Education

- What are professional competencies?
 - knowledge, skills, attitudes necessary for practice
 - professional communities determine competency requirements (consider healthcare ethics)
- Why competency-based education?
 - how is it different from time-based models?
 - learning-centered, assessments as priority
 - ex: milestones, entrustable professional activities
 - supervision, licensure, continuing education



Foundations: Interprofessional Teamwork

- Teamwork across boundaries in health care
- Co-development of tools and technologies
- Facing similar challenges of rapid change



Foundations: Evidence-Based Practice

- What is evidentiary basis to evaluate new tools?
- How can new tools contribute to EBP in health professions?
- How can frontline clinical users evaluate the quality of AI tools?



Futures:

Intro to Artificial Intelligence

- Computers, networks, data processing
- Algorithms for prediction and decision support
- Machine learning, neural networks, deep learning
- Applications for engineering, health, marketing
- Ongoing research and development
- Specific-use tools (current) v. general-AI (sci-fi)



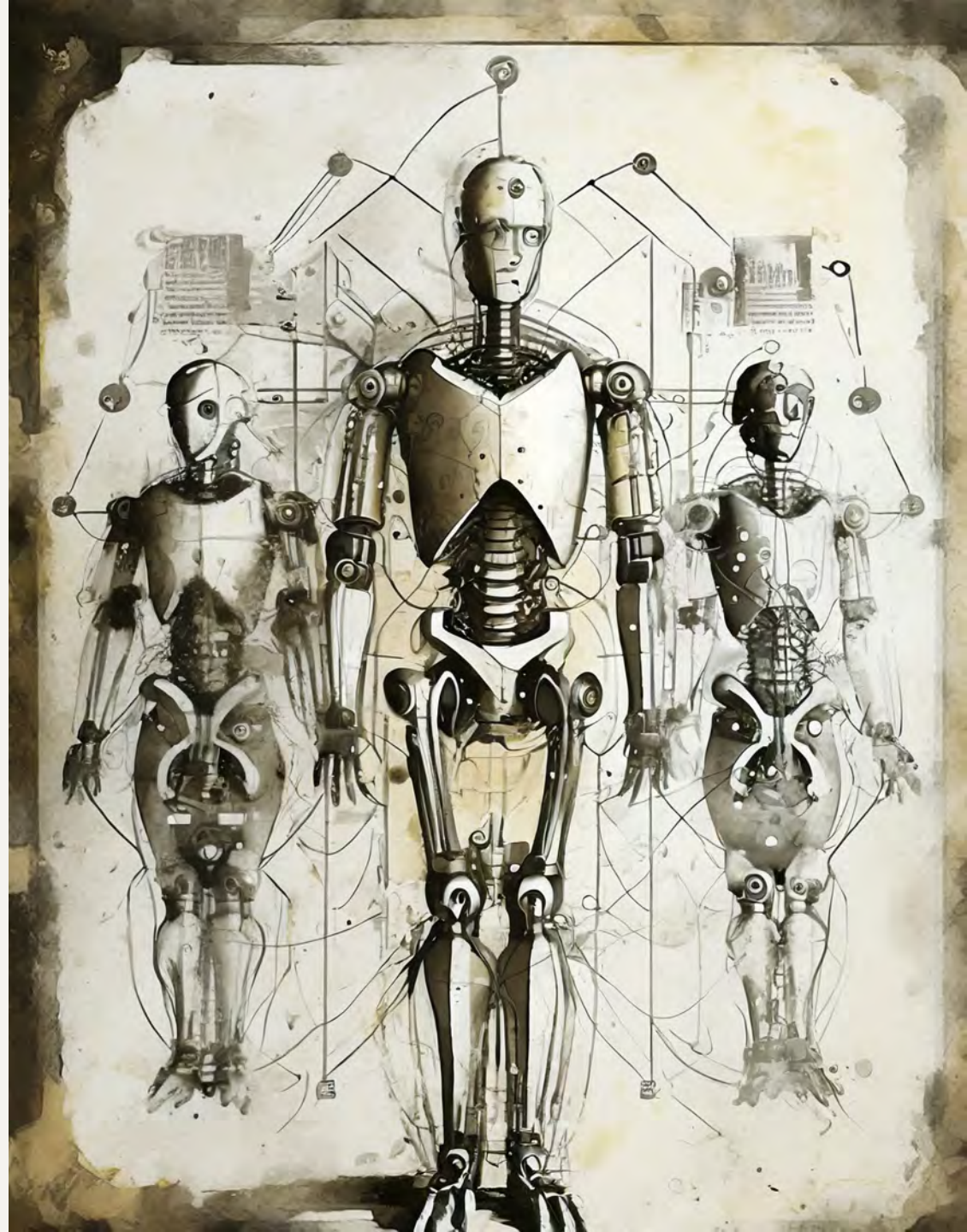
Futures: Ethical Challenges of AI

- safety, privacy, bias, training data (mis)representation, data sourcing, intellectual property, human impacts, economic and environmental costs . . .
- The Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence (Crawford, 2021)



Futures: Generative AI

- Computational advancements
 - Natural language, chips, storage
 - 21st century digital and social environments
- Generative capabilities
 - Text, image, audio, video, 3-D, multi-modal
 - Accessible to lay users
- Extensive ramifications
 - Individual, process, and policy
 - Organizational landscape includes institutions, professions, and governments



Futures:

AI-Based Tools in Health Care

- **Administrative teams** - Electronic health record, finance, workforce
- **Clinicians** - Care monitoring, diagnostics, information, communication
- **Patients** - Information seeking, health tracking
- Natural language processing, LLM integration
- Computer vision, robotic surgery, care-bots
- Predictive modeling, EHR and genetic data mining
- Diagnostics and imaging



Futures:

AI-Based Tools in HPE

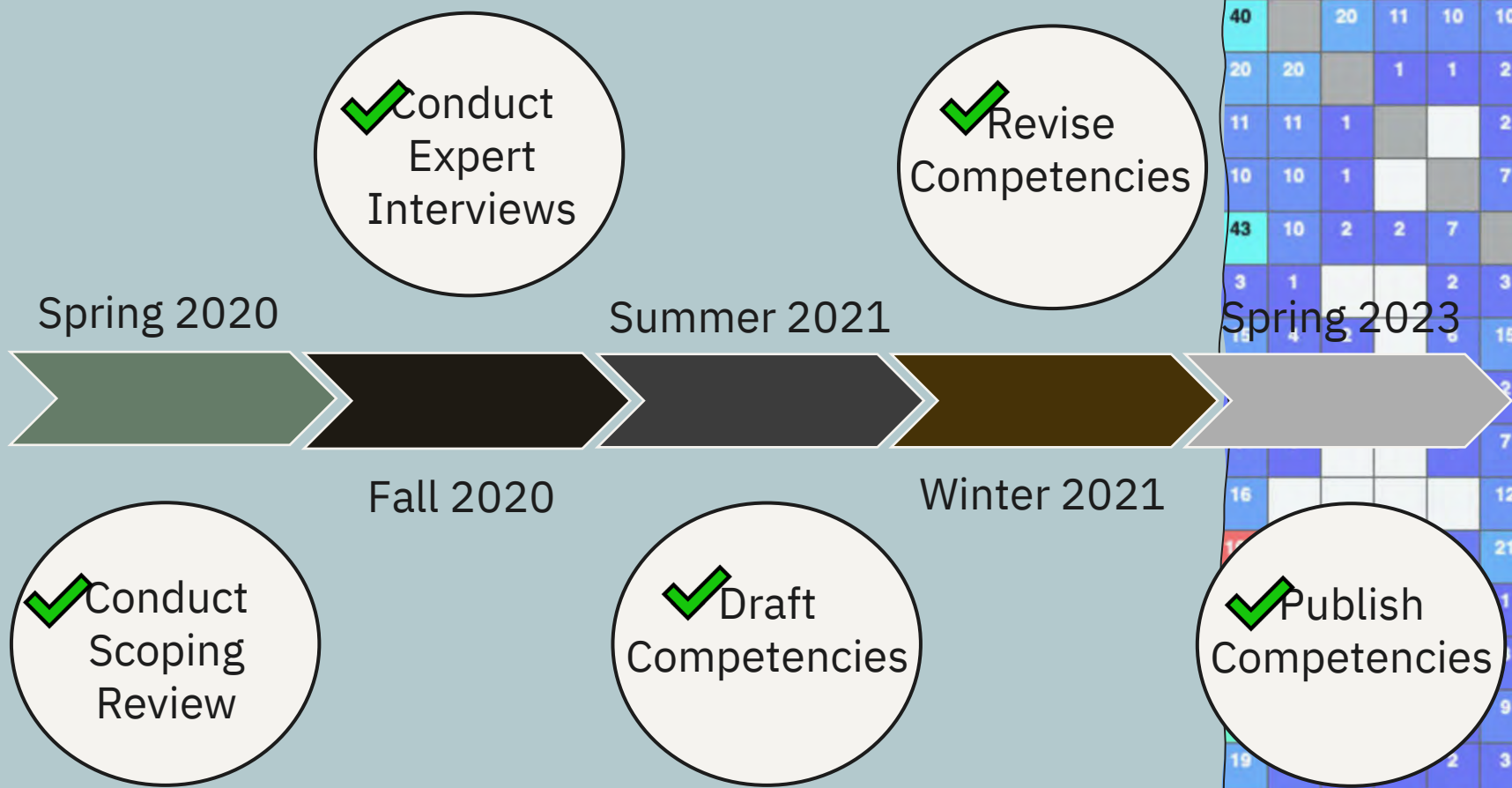
- **Administrative teams** - Enrollment, evaluation, systems improvement
- **Educators** - Course support, assessment, content
- **Learners** - Information seeking, progress tracking
- Natural language processing, LLM integration
- Educational automation, coach-bots
- Predictive modeling, student data mining
- Computer vision assessments, VR simulations



Research Collaborative

- IBM Watson Health, Vanderbilt University Medical Center, Vanderbilt University
- *What are the competencies necessary for the ethical and effective use of artificial intelligence-based tools in clinical settings?*



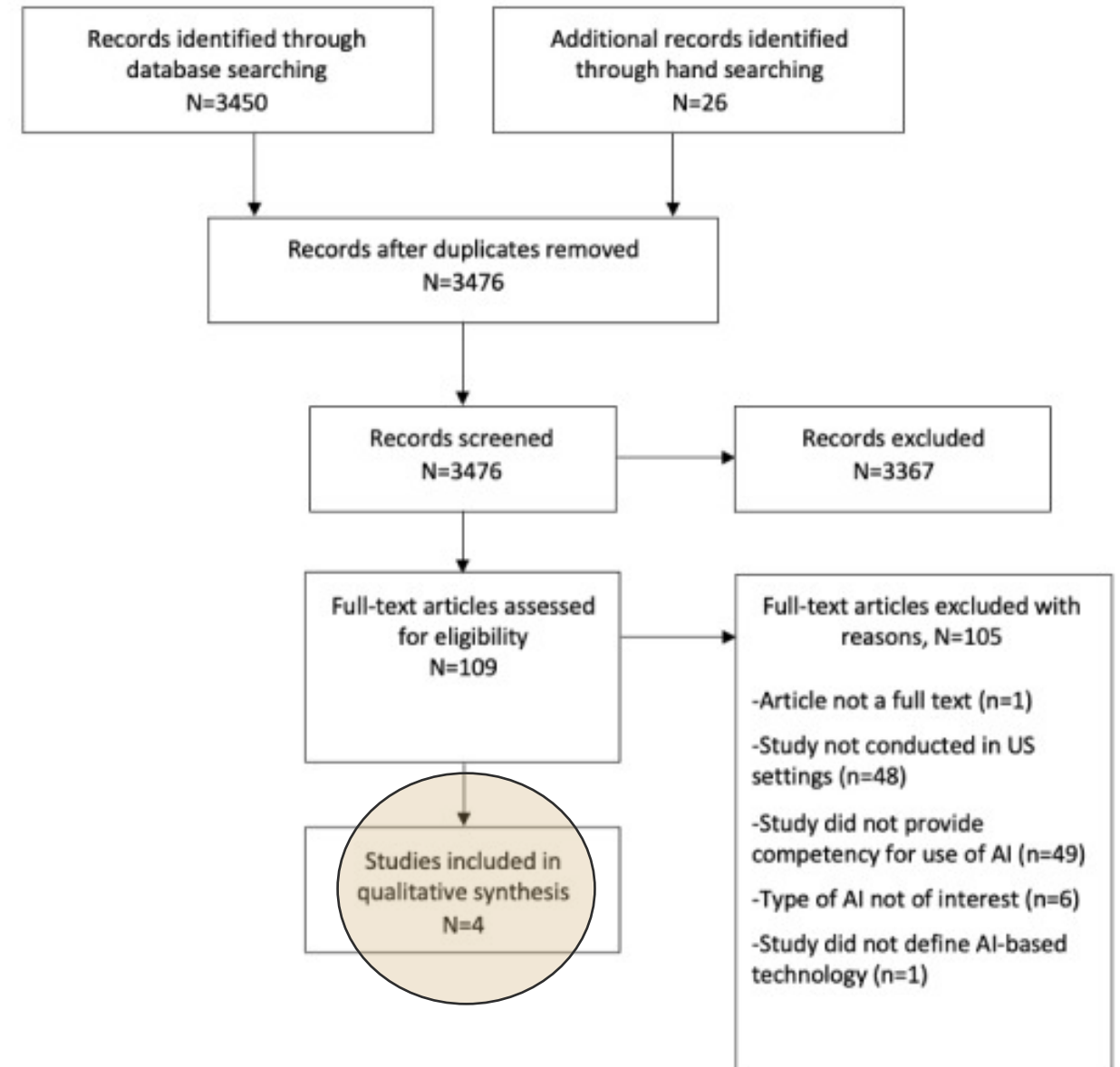


Competencies -	Interpersonal	communication	communication	communication	Interprofessional	boundaries	distributed k	hierarchy	organization	working with	Knowledge for	bias and lim	broad and n	data science	image signal	informatics	knowledge n	machine lea
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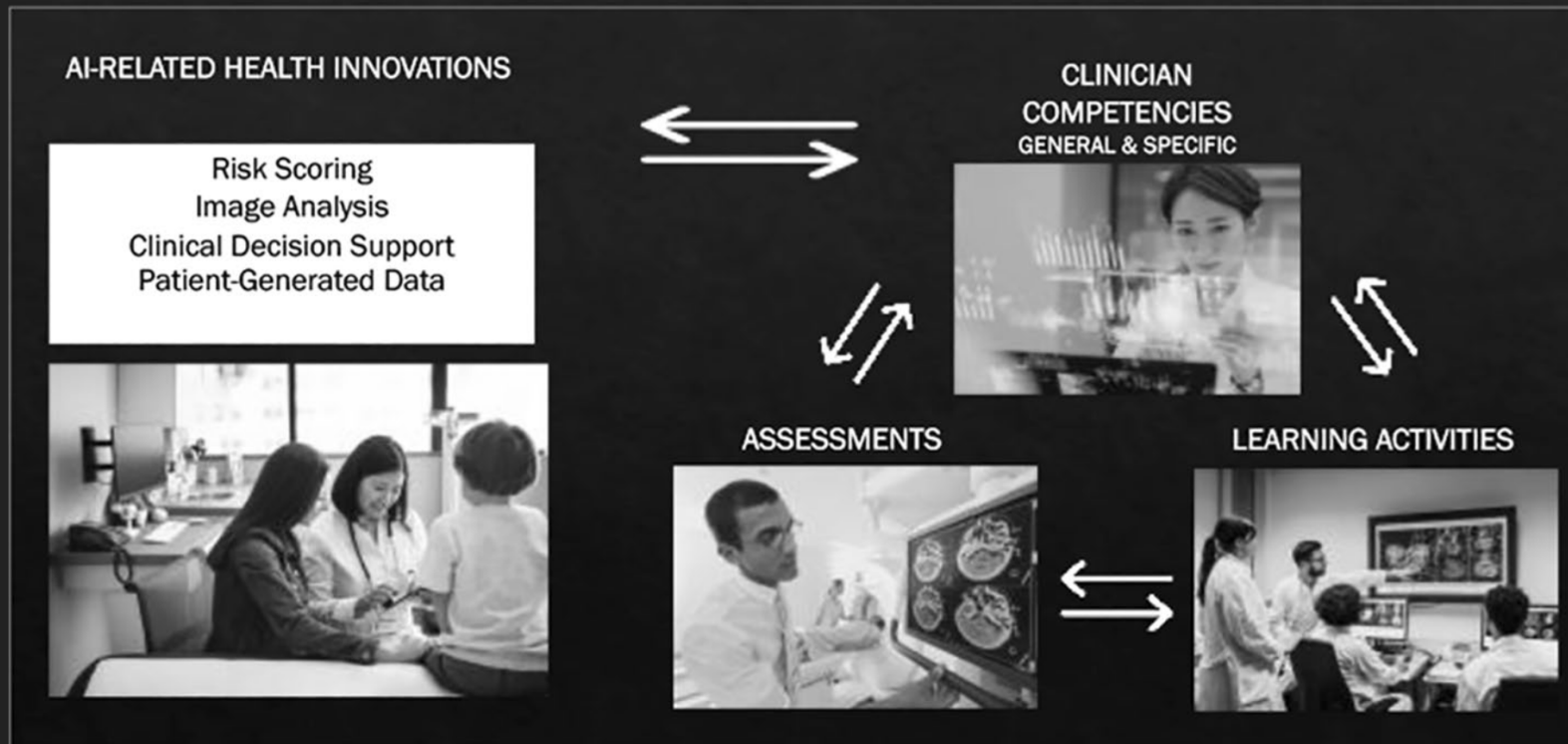


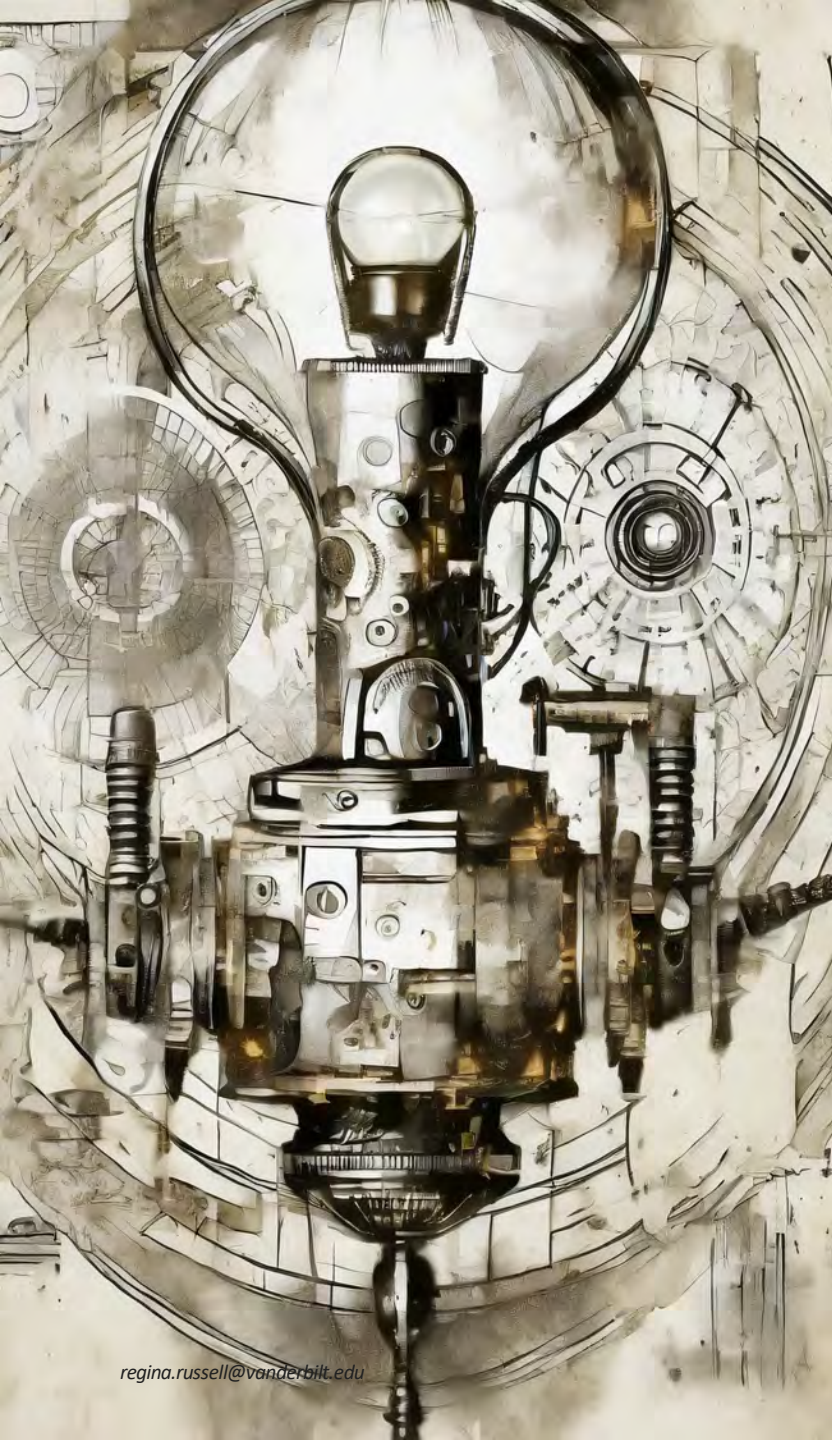
Human & Machine Learning



V Educational Gap

COMPETENCY BASED LEARNING FOR AI INNOVATIONS IN HEALTHCARE





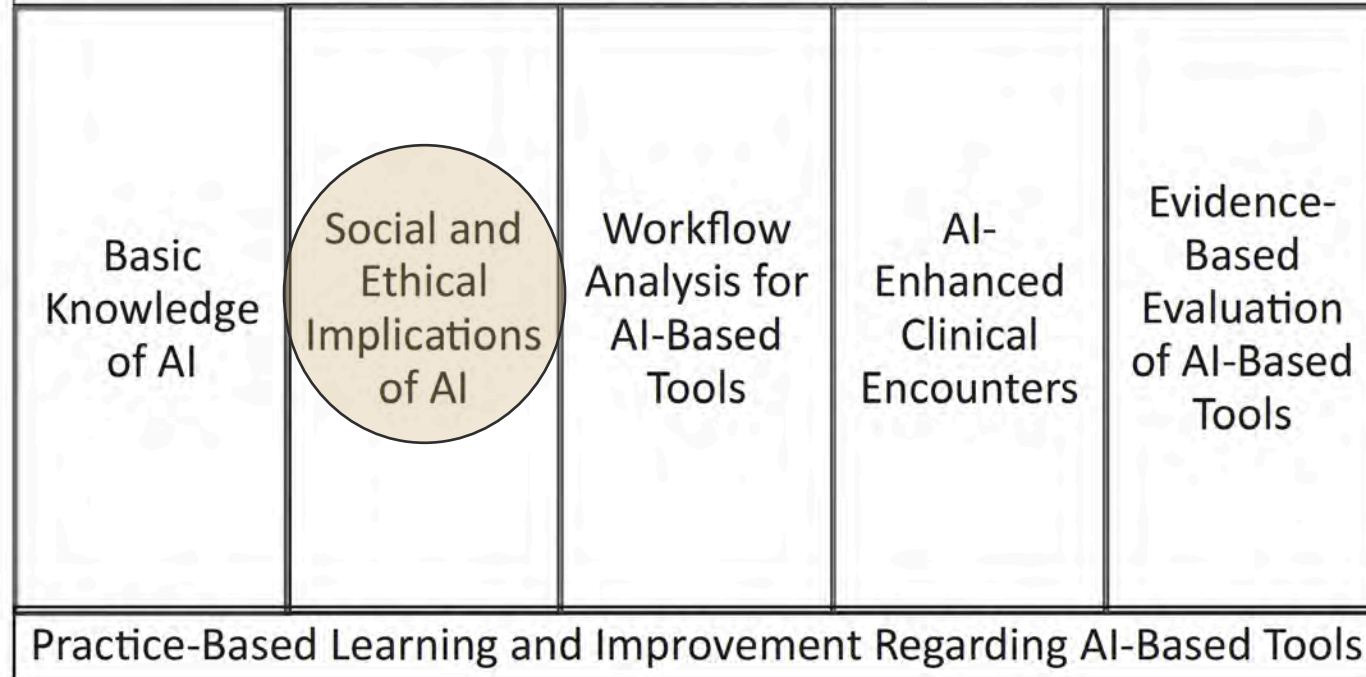
Expert Informant Interviews



SME	Profession	Expertise
1	Nursing	Informatics, data science
2	Medicine	Internal medicine, medical education
3	Medicine	Informatics, medicine
4	Nursing	Informatics, public health, nursing
5	Medicine	Medical imaging, machine learning
6	Medicine	Diagnostic radiology, computer science
7	Medicine	Internal medicine, biomedical informatics
8	Medicine	Interventional radiology, informatics
9	Bioethics	Bioethics, information technology ethics, public health ethics
10	Medicine	Medical education, surgery
11	Medicine	Biomedical informatics, internal medicine
12	Medicine	Informatics, data science, internal medicine
13	Pharmacy	Health informatics, pharmacy informatics
14	Social medicine	Computer and information science
15	Business, education	Social sciences, equity and inclusion



AI-Related Clinical Competencies for Health Care Professionals



Basic Knowledge of AI

Explain what artificial intelligence is and describe its health care applications.

- Identify the range of health-related AI applications.
- Describe contributions from the disciplines of data science, computer science, and informatics to the development of health care AI tools.
- Summarize the factors that influence the quality of data and explain how they impact the outputs of AI-based applications.
- Explain how different approaches to data visualization can affect interpretation of the outputs of AI-based tools and the subsequent actions that might be taken.
- Describe the statistical properties of AI-based tools and explain how they should be used in interpreting outputs.



Social and Ethical Implications of AI

Explain how social, economic, and political systems influence AI-based tools and how these relationships impact justice, equity, and ethics.

- Acknowledge personal responsibility for fairness and equity in the use of AI-based tools in health care.
- Describe how system-level factors and regulatory structures influence the implementation of AI-based tools in health care.
- Identify and evaluate how personal and structural biases can impact health data and the outputs of AI-based tools.
- Recognize the potential for use of AI-based tools to reduce or exacerbate health disparities and participate in debiasing activities to mitigate negative impacts.
- Appraise the ethical issues for clinicians, patients, and populations raised by various design, implementation, and use scenarios involving AI.



Workflow Analysis for AI-Based Tools

Analyze and adapt to changes in teams, roles, responsibilities, and workflows resulting from implementation of AI-based tools.

- Participate collaboratively in team-based discussions that analyze changing roles, responsibilities, and workflows associated with the adoption of novel AI-based tools and help implement necessary changes.
- Effectively use AI-based tools to facilitate critical communications between all members of health care teams.
- Recognize data and informatics professionals as valuable members of health care teams and collaborate with them in the design of AI tools that address clinical problems.
- Contribute to micro- and macro-system decision-making processes regarding which AI-based tools should augment and which should replace parts of current health care practices.



AI-Enhanced Clinical Encounters

Carry out AI-enhanced clinical encounters that integrate diverse sources of information in creating patient-centered care plans.

- Recognize that clinicians are responsible for all patient care decisions, including those that involve support from AI-based tools, and exercise judgment in applying AI-generated recommendations.
- Discern a patient's information needs, preferences, numeracy, and health literacy levels regarding the use of AI-based tools in their care.
- Explain to patients the concepts of risk and uncertainty as they relate to the outputs of AI-based tools and describe practical implications for their care.
- Integrate information derived from multiple AI and non-AI sources in patient-centered decision-making processes that result in personalized care plans.
- Demonstrate comfort and humility in caring for data-empowered patients and incorporate patient-reported data and outcomes in developing care plans.
- Apply methods of data visualization to facilitate patient understanding of AI-derived data, with sensitivity to possible differential impacts related to race, ethnicity, sex, gender, and social determinants of health.
- Describe how AI-based tools can be used to enhance access and quality of care in remote and underserved settings.



Evidence-Based Evaluation

Evaluate the quality, accuracy, safety, contextual appropriateness, and biases of AI-based tools and their underlying datasets in providing care to patients and populations.

- Access critical information about specific AI-based tools before applying them to patient care, including sources and representativeness of training data, algorithm performance for the question being asked, and how they were validated.
- Describe how the scope and quality of data sets used in development of AI tools influence their applicability to specific patients and populations.
- Identify potential biases in the design of an AI-based tool, and the implications of those biases for patient care and population health.
- Collaborate with patients, caregivers, informaticians, and others in the ongoing monitoring of AI-based applications and communicate feedback through established organizational channels.



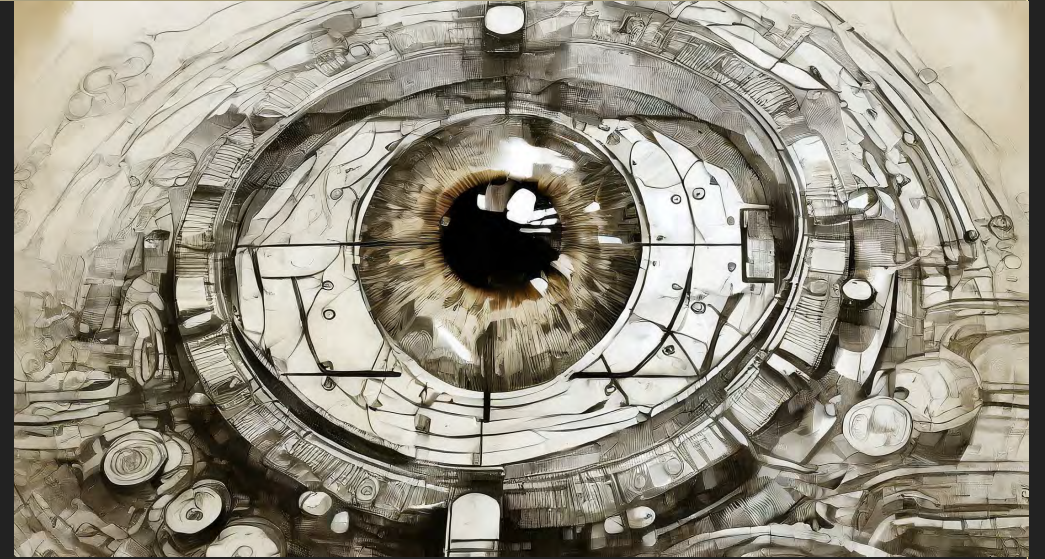
Practice-Based Learning and Improvement

Participate in continuing professional development and practice-based improvement activities related to use of AI tools in health care.



V Health Care Ethics

“We have seen what AI does when it ignores equity and inclusion in criminal justice, in education, in housing, in you name it. We should not have done it in those fields, and we certainly cannot do it in health care.”



“Health care
is about
humans first.”

V Competencies are System Dependent



Policy and Regulatory Implications



- Safety
- Privacy
- Intellectual Property
- Cybersecurity
- Infrastructures
- Costs
-much more

Role of Professional Communities

- Ethics
- Context
- Guidelines
- Monitoring
- **Education**
- ...much more

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Thank you!



Questions?

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