Data Science, Artificial Intelligence, and Health Working Group Final Report

May 2025

NIH National Institute of Nursing Research

EXECUTIVE SUMMARY

The Artificial Intelligence (AI) & Data Science (DS) Working Group was established under the auspices of the National Advisory Council for Nursing Research (NACNR), the advisory council to the National Institute of Nursing Research (NINR). For clarity, the Working Group defines AI as “the science of making machines do things that would require intelligence if done by humans”. The Working Group was charged with recommending to the NACNR future directions for NINR-supported science and training within the area of AI and data science by identifying pressing research questions and training needs and opportunities that could be addressed using nursing science’s multi-level approach to improving health. Between September and October 2024, the working group met three times to discuss the current state of the science and pressing research questions and training needs, and to develop recommendations for areas of research where nursing science and NINR can potentially have the biggest impact. The working group believed that NINR and nursing science were well-positioned to play key roles in this area of research, and that NINR should be bold and creative in its thinking as it considers future research directions and mechanisms in AI and data science.

Four priority research recommendations, two priority training recommendations and seven additional research recommendations were developed from the working group discussions. Note that the order in which the priority research recommendations are listed are in priority order, the training recommendations are tied for priority, and the order of the additional research recommendations do not imply priority.

RECOMMENDATION SUMMARY

Priority Research Recommendations (in order of priority)
1. NINR should support nurses and other interdisciplinary scientists to lead AI research agendas addressing differences in health and disease distribution and conditions of daily life.
2. NINR should promote research, systems, and organizational level initiatives to improve digital infrastructure, ensuring equal access to AI technologies.
3. NINR should encourage the engagement of patients, families, and communities in all stages of AI algorithm development and evaluation to ensure acceptability and use of the design and improve model accuracy.
4. NINR should encourage nurses and interdisciplinary scientists to use a perspective that accounts for conditions of daily life in AI data analysis to mitigate bias and minimize differences in health and disease distribution.
Training Recommendation (tied for priority)
1. Develop targeted AI training programs to advance nurse scientists' competency in conducting AI-focused research through a lens that acknowledges conditions of daily life that result in differences in health and disease distribution and include dedicated, formal education in informatics, clinical decision support, and AI.
2. NINR should encourage all training programs to provide students with a foundational education in AI to prepare them for its integration into nursing science and practice.
Additional Research Recommendations
1. NINR should facilitate partnerships between nurse scientists and industry to develop innovative, patient-centered AI technologies.
2. NINR should support the development and adoption of standardized nursing data structures to facilitate large-scale data harmonization and integration into national health analyses.
3. NINR should facilitate a systematic approach to integrating AI applications in nursing, including clinical decision support (CDS), patient education, documentation, and predictive analytics.
4. NINR should prioritize research on identifying and mitigating biases in AI tools to promote healthcare outcomes for all peoples.
5. NINR should support the development of standardized frameworks for bias assessment and continuous monitoring of AI algorithms in healthcare.
6. NINR should foster nurses' critical evaluation of AI-generated data to ensure professional judgment is upheld in patient care.
7. NINR should support research approaches that produce enduring, adaptable solutions to keep pace with rapid AI advancements in healthcare.

BACKGROUND AND MISSION

The National Institute of Nursing Research (NINR) leads nursing research to solve pressing health challenges and inform practice and policy, optimizing health for all. NINR's strategic plan includes a research framework that takes advantage of what makes the Institute unique by focusing on a holistic, contextualized approach to optimizing health for all people, rather than on specific diseases, life stages, or research topics. NINR's strategic vision leverages the strengths, and unique knowledge and perspectives inherent to the nursing discipline, to address urgent health challenges.

Rapid developments in data science and artificial intelligence (AI) have tremendous implications for nursing science – for not only the research questions which need answers to improve health outcomes, but also for the science that can be used to answer those questions. At the same time, algorithms trained on incomplete or biased data can erode trust and generate unsafe recommendations. Nursing science, which has always examined health in its full personal, relational, and societal context, is therefore at a critical inflection point: it must both seize the unprecedented analytic power of AI/DS and ensure that its benefits are distributed ethically and for all people.

Recognizing this urgency, the National Institutes of Health (NIH) has launched cross-agency investments—such as Big Data to Knowledge (BD2K) program and the new NIH-wide Artificial Intelligence initiatives—to curate FAIR (findable, accessible, interoperable, reusable) datasets, build an AI-ready workforce, and accelerate trustworthy, impact-driven innovation. NINR is a participating institute in several NIH-wide artificial-intelligence and data-science efforts—including the Common Fund's BD2K program, the interagency Smart Health and Biomedical Research in the Era of AI and Advanced Data Science solicitation, and Office of Data Science Strategy supplements that ready NIH datasets for machine-learning analyses and embed ethical, bias-aware safeguards. Through these coordinated initiatives, NIH seeks to harness trustworthy AI and data science to generate context-rich evidence and interventions that empower individuals, families, and communities, directly advancing NINR's holistic mission to optimize health for all through practice-informing science.

Nurses generate much of the real-world data that fuel healthcare AI systems, understand the workflows in which algorithms must function, and maintain direct, longitudinal relationships with the individuals and communities those systems are meant to help. Nurse scientists are thus uniquely positioned to detect bias in data sources, co-design transparent and context-aware models with stakeholders, and translate AI insights into holistic, person-centered interventions that respect professional judgment. By elevating nurse-led inquiry, fostering interdisciplinary collaboration, and training the nursing workforce to both critique and create AI, NINR can ensure that the next wave of AI/DS advances not only predicts and prevents illness but also strengthens compassion, and trust across every setting of care.

WORKING GROUP

At its September 2024 meeting, the National Advisory Council for Nursing Research (NACNR) approved the formation of a working group to consider the current state of the science aligned with NINR's strategic vision and of the nursing science workforce; and assess pressing research questions and training needs and opportunities in the nursing science field. The AI and Data Science Working Group, established under the NACNR in September 2024, was then charged with recommending to the NACNR future directions for NINR-supported science within this area of AI and data science. The working group was asked to assess pressing research questions and training needs and opportunities in the nursing science field and recommend areas of research and training where nursing science can potentially have the biggest impact.

The Working Group consisted of experts in data science and AI in health research and related fields, from both within and outside of the nursing science community and was co-chaired by NINR's Senior Advisor to the Director and a member of the NACNR. A full list of the Working Group members can be found in **Appendix B**.

The Working Group met virtually three times between September and October 2024 to discuss nursing research's potential role in addressing multiple factors related to artificial intelligence and data science. For the purposes of this report, the Working Group defined Artificial Intelligence (AI) as the science of making machines do things that would require intelligence if done by humans. During the Working Group's robust deliberations, many potential research ideas were proposed and discussed, and were subsequently synthesized, and refined by the group during meetings and over e-mail. The Working Group's ideas formed the basis for the recommendations presented in this report. The draft recommendations were provided to the NACNR at its May 20th, 2025 meeting.

Overall, the Working Group concluded that:

- Nurse scientists are uniquely positioned to lead AI and data-science innovation because they generate much of the real-world data that feed algorithms, understand clinical workflows, and maintain longitudinal relationships with the people and communities those systems are meant to help.
- AI-enabled nursing research must deliberately tackle health issues by embedding conditions of daily life and other social-determinant data into model design, testing, and evaluation, so tools work fairly for all.
- NINR should invest in digital infrastructure and foster early, sustained engagement of patients, families, and communities to ensure trustworthy, context-aware AI solutions that are accessible for all people.
- Bold, interdisciplinary training and industry partnerships are essential so the nursing workforce can create, critique, and continuously monitor bias-aware AI tools that advance person-centered care.

RESEARCH RECOMMENDATIONS

Priority Recommendation 1

NINR should support nurses and other interdisciplinary scientists to lead AI research agendas addressing differences in health and disease distribution and conditions of daily life. To meet this goal, NINR should support research that:

- Leverages AI tools to develop health interventions that address the unique needs of individuals across a variety of backgrounds.
- Applies AI tools to address conditions of daily life, identifying effective methodologies and data collection strategies to minimize differences in outcomes.
- Develops AI driven strategies, integrating conditions of daily life and identifies and mitigates differences in health for all and tests these innovations while ensuring that all populations are adequately represented.

Priority Recommendation 2

NINR should promote research, systems, and organizational level initiatives to improve digital infrastructure, ensuring equal access to AI technologies. To meet this goal, NINR should support research that:

- Develops and tests systems and organizational level interventions that decrease differences in digital access and promote adoption of AI technologies while exploring how health systems in rural/urban areas [RUAs] can leverage these tools to address conditions of daily life, reduce differences in care, and improve health outcomes for all.
- Identifies and addresses system level challenges—such as infrastructure, workforce capacity, and internet connectivity—that hinder the adoption of AI-enabled clinical decision support tools in RUAs and develop strategies to improve equitable access to these technologies.
- Examines innovative approaches and best practices for implementing AI-based healthcare solutions in RUAs, focusing on developing digital infrastructure and strategies to promote sustainable, equitable, and inclusive access to AI tools and applications.
- Designs and adapts AI technologies that support individuals in RUAs with varying levels of digital health literacy and varying degrees of digital access.

Priority Recommendation 3

NINR should encourage the engagement of patients, families, and communities in all stages of AI algorithm development and evaluation to ensure acceptability and use of the design and improve model accuracy. To meet this goal, NINR should support research that:

- Develops and tests methods and models to meaningfully engage patients, families, and communities in AI innovation, focusing on building trust in AI systems, examining how early participation of community stakeholders influences the long-term success and efficacy of AI-driven healthcare solutions, and establish systematic frameworks to facilitate this engagement.
- Develops, implements, and evaluates strategies to engage patients, families, clinicians, and communities in the co-design and evaluation of AI tools, with a focus on building trust and ensuring transparency in the performance, limitations, and fairness. Such collaboration should promote health interventions tailored to local populations and improve the accuracy and fairness of predictive health models. Achieving this can be done by embedding user-centered design principles and clinical decision support into AI innovation.

Priority Recommendation 4

NINR should encourage nurses and interdisciplinary scientists to use a perspective that accounts for conditions of daily life in AI data analysis to mitigate bias and minimize differences in health and disease distribution. To meet this goal, NINR should support research that:

- Establishes or enhances governance structures and related models—such as theoretical, clinical, and ethical frameworks—by systematically integrating a conditions of daily life perspective into AI algorithms, ensuring continuous monitoring and reduction of health and disease distribution differences.
- Designs and validates AI models incorporating conditions of daily life, including identifying specific strategies to integrate such factors into these models. These efforts aim to improve fairness, performance, and bias mitigation while contributing to more accurate outcomes across a variety of patient populations.
- Innovates methods to assimilate and integrate conditions of daily life data with nursing data, incorporating multi-modal and a wide range of real-world data sources.

TRAINING RECOMMENDATIONS

Training Recommendation 1

Develop targeted AI training programs to advance nurse scientists' competency in conducting AI-focused research through a lens that acknowledges conditions of daily life that result in differences in health and disease distribution and include dedicated, formal education in informatics, clinical decision support, and AI. To meet this goal, NINR should invest in training programs that:

- Increase awareness and competency in areas such as AI literacy, ethical AI use, bias mitigation, data interpretation, and clinical applications of AI tools.

Training Recommendation 2

NINR should encourage all training programs to provide students with a foundational education in AI to prepare them for its integration into nursing science and practice. To meet this goal, NINR should invest in training programs that:

- Provide formal education in informatics, clinical decision support, and AI.
- Build AI education upon foundational informatics education, incorporating training on sources of bias in AI and strategies for preventing and addressing bias.

ADDITIONAL RESEARCH RECOMMENDATIONS

NINR should facilitate partnerships between nurse scientists and industry to develop innovative, patient-centered AI technologies.

- Strengthen capabilities for timely software and system development with financial resources beyond what NIH can provide.
- Optimize new AI innovations to align with nursing decisions and priorities.
- Partner with industry to tailor foundation and large language models (LLMs) for nursing applications.
- Design and evaluate AI technologies that prioritize patient-centeredness and clinical relevance from the earliest stages of development.
- Identify factors for successful nurse scientist-industry partnerships to prioritize patient-centered AI technologies.
- Develop and adapt collaborative models between academic nursing researchers and industry partners to ensure long-term success and sustainability in AI-driven healthcare innovations.

NINR should support the development and adoption of standardized nursing data structures to facilitate large-scale data harmonization and integration into national health analyses.

- Identify and address barriers to developing and adopting standardized nursing data structures across healthcare settings, enabling large-scale data harmonization.
- Establish or enhance consortia and supporting infrastructure to enable the sharing of harmonized nursing data across sites, promoting collaborative research and large-scale data integration.
- Ensure interoperability of conditions of daily life data from local screenings and integrate these data into national health datasets to support comprehensive health analyses.
- Establish best practices for structuring nursing data to facilitate its integration with national healthcare databases, with the aim of reducing differences in data availability and quality across different regions and populations.
- Design and validate foundation models that incorporate nursing data and evaluate the impact of these models on AI performance for both general healthcare and nursing-specific tasks.
- Optimize clinical decision support tools for predicting health outcomes, focusing on ensuring interoperability across diverse healthcare systems and data platforms.

- Evaluate the impact of non-standardized nursing data on national health outcomes and explore potential improvements that could be achieved by integrating nursing data into national health analytics frameworks.

NINR should facilitate a systematic approach to integrating AI applications in nursing, including clinical decision support (CDS), patient education, documentation, and predictive analytics.

- Develop approaches to optimize generalizability, scalability, and widespread adoption of AI in nursing practice.
- Create systematic frameworks to integrate AI into nursing, focusing on CDS, education, documentation, and predictive analytics.
- Focus programmatic innovation using AI to advance nursing care in high-priority areas such as chronic disease and pain management.
- Examine nursing tasks best suited for enhancement through AI based on current data resources, technologies, and CDS principles.
- Incorporate predictive analytics into nursing practice to enhance patient outcomes and identify potential barriers to adoption across diverse healthcare settings.
- Support personalized care by leveraging AI tools to incorporate real-time nursing assessments and patient outcomes.
- Promote nursing adoption and sustained use of CDS tools through strategies like training, usability testing, and other effective practices.
- Incorporate AI into nursing education through effective strategies that prepare nursing professionals to use AI in CDS and documentation.
- Monitor and calibrate AI-based tools over time to maintain performance and prevent unintended consequences.
- Enhance nursing interventions with predictive analytics embedded in AI tools for early detection of patient deterioration and proactive care planning.

NINR should prioritize research on identifying and mitigating biases in AI tools to promote healthcare outcomes for all people.

- Develop and implement fairness and bias mitigation strategies throughout the AI/ML development lifecycle to enhance the equitable performance of predictive models and improve downstream outcomes.
- Develop and apply frameworks to evaluate and mitigate bias in AI healthcare algorithms, ensuring these tools promote fairness in predictive accuracy and clinical outcomes while designing and evaluating equitable AI systems.
- Design and validate frameworks for bias assessment in AI/ML algorithms to ensure fair and accurate predictions of health outcomes across all patient populations.
- Develop innovative methods to prevent and detect bias.
- Identify data sources and algorithmic design choices contributing to biases in AI healthcare tools and develop strategies to systematically identify and mitigate these biases across all patient populations.
- Examine how biases in AI-driven clinical decision support systems exacerbate existing differences in the distribution of disease and heath across populations, and implement proactive measures to reduce these biases during AI development and implementation.

- Adapt bias assessment frameworks to address nursing-specific tasks and priorities.
- Develop methods to mitigate sources of bias in nursing documentation.

NINR should support the development of standardized frameworks for bias assessment and continuous monitoring of AI algorithms in healthcare.

- Establish best practices for integrating bias assessment and monitoring into the AI algorithm development lifecycle to ensure that healthcare technologies evolve with a focus on fairness and minimizing harm to all populations.
- Evaluate and assess existing frameworks for systematic bias assessment in relation to nursing priorities and tasks.
- Advance frameworks and their associated tools.
- Identify key components for inclusion in a standardized framework for assessing bias in AI healthcare algorithms, ensuring consistent evaluation across all clinical settings and populations.
- Design continuous monitoring systems for AI healthcare tools to detect and mitigate bias over time, with nurse scientists playing a key role in ensuring these systems remain responsive to emerging differences in the distribution of diseases and health.

NINR should foster nurses' critical evaluation of AI-generated data to ensure professional judgment is upheld in patient care.

- Conduct research to enhance education, preparing nurses to engage with AI technologies critically.
- Enhance informatics education and training with a focus on clinical decision support.
- Develop training programs that equip nurses to critically evaluate AI data in clinical settings, along with frameworks that ensure that recommendations support, rather than replace, professional nursing judgment.
- Identify the most common challenges nurses face when integrating AI-generated data into patient care decisions and address these challenges to maintain the integrity of clinical judgment.
- Design AI tools that complement nursing expertise, promote critical evaluation, and reduce the risk of over-reliance on algorithmic outputs in patient care decisions.

NINR should support research approaches that produce enduring, adaptable solutions to keep pace with rapid AI advancements in healthcare.

- Promote the use of standards and encourage the open sharing of developed tools and resources.
- Build industry partnerships to develop software and tools.
- Develop research methodologies and collaborative models to ensure nursing science keeps pace with rapid AI advancements while producing adaptable and sustainable healthcare solutions.
- Structure nurse-led research initiatives to foster flexible AI innovations that can quickly integrate into clinical practice without compromising quality of care.
- Identify factors contributing to AI solutions' long-term sustainability and adaptability in healthcare. Design research approaches to address these factors while fostering continuous improvement.

APPENDIX A

Acronyms

AI	Artificial Intelligence
CDS	Clinical Decision Support
DS	Data Science
LLM	Large Language Model
ML	Machine Learning
NACNR	National Advisory Council for Nursing Research
NIH	National Institutes of Health
NINR	National Institute of Nursing Research
RUA	Rural and Underserved Area

APPENDIX B

Working Group Member List

Co-Chairs

- Patricia Stone, PhD, MPH, MSN, BSN, FAAN, FAPIC, Columbia University School of Nursing
- Yvonne Bryan, PhD, NINR

Members

- Jing Wang, PhD, MPH, RN, FAAN, Florida State University College of Nursing
- Anne Fitzpatrick, PhD, Emory University School of Medicine
- Soroush Saghafian, PhD, MS, MD, Harvard Kennedy School
- Michael Cary, PhD, RN, Duke University School of Nursing
- George Demiris, PhD, FACMI, University of Pennsylvania
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