VIEWPOINT

Artificial Intelligence in Health Care
A Report From the National Academy of Medicine

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The promise of artificial intelligence (AI) in health care offers substantial opportunities to improve patient and clinical team outcomes, reduce costs, and influence population health. Current data generation greatly exceeds human cognitive capacity to effectively manage information, and AI is likely to have an important and complementary role to human cognition to support delivery of personalized health care.[1] For example, recent innovations in AI have shown high levels of accuracy in imaging and signal detection tasks and are considered among the most mature tools in this domain.[2]

However, there are challenges in realizing the potential for AI in health care. Disconnects between reality and expectations have led to prior precipitous declines in use of the technology, termed *AI winters*, and another such event is possible, especially in health care.[3] Today, AI has outsized market expectations and technology sector investments. Current challenges include using biased data for AI model development, applying AI outside of populations represented in the training and validation data sets, disregarding the effects of possible unintended consequences on care or the patient-clinician relationship, and limited data about actual effects on patient outcomes and cost of care.

AI in Healthcare: The Hope, The Hype, The Promise, The Peril, a publication by the National Academy of Medicine (NAM), synthesizes current knowledge and offers a reference document for the responsible

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development, implementation, and maintenance of AI in the clinical enterprise.[4] The publication outlines current and near-term AI solutions; highlights the challenges, limitations, and best practices for AI development, adoption, and maintenance; presents an overview of the legal and regulatory landscape for health care AI; urges the prioritization of equity, inclusion, and a human rights lens for this work; and outlines considerations for moving forward. This Viewpoint shares highlights from the NAM publication.

Promoting population-representative data with accessibility, standardization, and quality is imperative. Health care AI should be trained and validated on population-representative data to ensure accuracy for all populations and to achieve performance levels necessary for scalable success. Trends such as decreasing cost for storing and managing data, data collection via

electronic health records, and exponential consumer health data generation, have created a data-rich health care ecosystem. However, there continue to be issues of data quality, appropriate consent, interoperability, and scale of data transfers. The current challenges are grounded in patient and health care system preferences, regulations, and political will rather than technical capacity or specifications. It is prudent to engage AI developers, users, and patients and their families in discussions about appropriate policy, regulatory, and legislative solutions.

Prioritize ethical, equitable, and inclusive health care AI while addressing explicit and implicit bias. This should be a clearly stated goal when developing and deploying tools in consumer and clinical settings. Today's health care inequities include societal bias, social determinants of health, and perverse incentives in the existing system. Further exacerbating the lack of trust are high-profile, biased AI deployed for judicial sentencing, facial recognition, and hiring practices.[5] It is essential to ascertain the applicability of the data used to develop AI by scrutinizing the underlying biases to understand its potential to worsen or address existing inequities, and whether and how it should be deployed.[6] Leveraging diverse data sets is essential, as is preventing unintended consequences resulting from privacy breaches and inappropriate deployment. A quintuple aim should be the goal, adding equity and inclusion to the quadruple aim of improving the health of the population, enhancing the patient experience, reducing per capita cost, and enhancing clinician wellness.

Contextualizing the dialogue of transparency and trust requires accepting differential needs. Full transparency with respect to the population-representativeness, composition, semantics, provenance, and quality of data used to develop AI tools is critical. There also needs to be full transparency and assessment of relevant performance components of AI. However, algorithmic transparency should not be required for all use cases. AI developers, implementers, users, and regulators should collaboratively define guidelines for clarifying the level of transparency needed across a spectrum. There should be a clear separation of data, performance, and algorithmic transparency.

Near-term focus is needed on augmented intelligence vs AI autonomous agents. Fully autonomous AI is inciting public concern and faces numerous technical and regulatory challenges. Realistically, the current opportunity is *augmented intelligence*, supporting data synthesis, interpretation, and decision-making for clinicians, allied health professionals, and patients.

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Focusing on this reality is essential for developing user trust because there is an understandable low tolerance for machine error, and these tools are being implemented in an environment of inadequate regulation and legislation.

Develop and deploy appropriate training and educational programs to support health care AI. The scale at which AI may change the landscape of prevention, diagnosis, treatment, and health care management is substantial. The curricula must be multidisciplinary and engage AI developers, implementers, health care system leadership, frontline clinical teams, ethicists, humanists, patients, and caregivers. Each group brings much needed perspectives, requirements, and expertise. Data science curricula should expand to include teaching how engaging diverse development teams is likely to improve the utility and effect of AI, and also to raise the awareness of ethics, equity, inclusion, and potential unintended consequences. Health care professional training should incorporate curricula on how to appropriately assess and use AI products and services. Adding these components via continuing education for current practitioners in all relevant fields should be a priority. Consumer health educational programs, at all educational levels, are needed to help inform consumers about consent, privacy, and health care AI savviness.

Leverage frameworks and best practices for learning health care systems, human factors, and implementation science to address the challenges in operationalizing health care AI. The AI community should develop guidance on best practices for inclusivity and equity, software development, implementation science, and human-computer interaction, all within the framework of the learning health care system. Health care delivery systems should have a robust and mature information technology (IT) governance strategy prior to em-barking on substantial AI deployment and integration. In addition, a national focus on providing appropriate health care AI in resource constrained environments is needed.

Balance innovation with safety via regulation and legislation to promote trust. AI has the potential to improve patient outcomes but could also pose significant risks in terms of inappropriate or inaccurate patient risk assessment, treatment recommendations, diagnostic error, privacy breaches, and other factors. While regulators should remain flexible, the potential for lagging legal responses will remain a challenge for AI innovation. Recent congressional and US Food and Drug Administration developments and guidance have made progress, and it is important to pursue a graduated approach based on levels of patient risk and AI autonomy, including considerations for static or dynamic AI. Liability will continue to evolve as regulators, courts, and the risk-management industries weigh in, and a careful balance and understanding of this is critical for AI adoption.[7] Regulators and patients and their families should encourage AI developers, health system leaders, clinical users, and informatics and health IT experts to evaluate deployed clinical AI for effectiveness and safety based on clinical data.

Conclusions

Health care is at a critical juncture for the safe and effective use of AI algorithms and tools in supporting the health of patients. The technical capacity exists to leverage these tools to transform health care. The challenges are unrealistic expectations, biased and nonrepresentative data, inadequate prioritization of equity and inclusion, the risk of exacerbating health care disparities, low levels of trust, uncertain regulatory and tort environments, and inadequate evaluation before scaling narrow AI.

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