CE 1.0 CONTACT HOUR

Harnessing the power of artificial intelligence

By Joyce Sensmeier, MS, RN-BC, CPHIMS, FHIMSS, FAAN

Electronic health records (EHRs) are nearly ubiquitous today, and they bring with them a surplus of data and information.[1] Nurses have been diligently entering data while documenting our patients' care and treatments, and we expect to benefit from the digital investment. That expectation may soon be realized through the application of advanced analytics and the capabilities of artificial intelligence (AI). In its essence, AI is a branch of computer science dealing with the simulation of intelligent behavior in computers.[2] Combining the experience, knowledge, and human touch of clinicians with the power of AI will improve the quality of patient care and lower its cost.[3]

Imagine using predictive models to make real-time inferences from a large patient population to generate alerts or predict patients' length of stay. AI can be used to automatically detect problems and threats to patient safety, such as patterns of sub-optimal care or outbreaks of hospital-acquired illness. Data from entire patient populations can be analyzed using AI to discover new evidence and determine best healthcare practices. These exciting advances may be coming sooner than we think. A recent study suggested that about 35% of healthcare organizations plan to leverage AI within 2 years, and

more than half intend to do so within 5 years.[4]

We can already see the impact of AI when we use a mobile app for directions or receive fraud alerts from our bank. Computer scientist Andrew Ng has called AI the "new electricity" with the potential to change how the world operates: "Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that won't be transformed by AI in the next several years."[5] The future of healthcare holds great promise for applying AI to improve many aspects of the care process. Potential benefits include personalizing treatments to maximize effectiveness, monitoring population health and outcomes, and discovering new evidence that will inform care delivery.[3]

At the same time, it takes 17 years to translate science into practice, and electronic healthcare data double every 24 months.[8] One company is leveraging this tsunami of information to develop a program for patient safety that can identify adverse events and offer safety alerts through automation.[9] The use of AI in healthcare will go far toward turning data into useful and actionable information that benefits the health and care of our patients.

The benefits

The potential for health information technology (HIT) to transform healthcare delivery and improve patient safety has long been a driver of adoption. Studies have demonstrated the correlation between HIT and clinical quality.[10] Results of a large nationally representative sample of Medicare patient data over 4 years show that EHRs have a clear and statistically significant effect on patient safety.[11] AI is an emerging use of technology that creates intelligent computer systems that perform tasks without receiving instructions directly from humans.[12] We anticipate that using AI as a tool to augment clinical judgment, experience, and education will enhance care delivery and improve patient safety in a number of ways.

Reducing human error

One in 10 medical diagnoses is wrong, according to the Institute of Medicine.[13] AI has the potential to transform medical practice and drastically reduce the number of medical errors. Recent studies demonstrate that AI systems are capable of matching the accuracy of specialists when diagnosing skin and lung cancer.[14] By reducing the likelihood of human errors, AI can contribute to more precise diagnoses and predictions of patient outcomes to enhance patient safety.[15] Add to this the benefits of faster diagnoses, reduced costs, and more personalized care and treatment, and the future of AI looks very bright.[16]

The use of AI in healthcare will go far toward turning data into useful and actionable information that benefits the health and care of our patients.

Healthcare is one of the most data-rich industries, driven by digital health, image capture, and widespread EHR adoption. Between EHRs, digitized diagnostics, and wearable medical devices, the average person will leave a trail of more than 1 million gigabytes of health-related data in their lifetime.[6] According to *Harvard Business Review,* 30% of the world's electronic data storage is occupied by healthcare information.[7]

AI apps can also give patients the tools they need to manage their own health and transfer knowledge to their providers. Intelligent computing can provide higher levels of patient engagement and education such as adaptive personalized response. One AI technology connects ambulances with hospitals so they can receive patient information before arrival, saving time and ultimately improving care.[17]

Personalizing treatment

The majority of treatment plans and protocols in use today were developed based on individual or organizational experience. However, AI can use algorithms, or predictive models, to analyze volumes of data from multiple patient populations to provide more accurate and personalized healthcare.[18] These models can determine the likelihood that a patient will undergo a specific health event or develop a chronic illness, such as Alzheimer disease, in the future. How powerful will that be when we're able to anticipate and perhaps prevent disease or eliminate the potential negative health outcomes?

According to research published by Stanford University, AI can be used to spot patterns in large data sets and mine data from millions of EHRs with speed and efficiency that humans can't match.[19] This large-scale analysis can result in personalized patient diagnosis and treatment. For example, for patients recovering from a stroke or trauma, a cloud-based system involving sensor technology can provide tailor-made physiotherapy performed in the home. Immediate feedback to the patient provides guidance on the correct therapy movements.[20]

These developments have the potential to radically transform healthcare delivery as electronically recorded medical treatments and clinical assessments for millions of patients become available. Similarly, the capture and mining of data from an increasing number of wearable devices and mobile apps will further expand personalized medicine. Population-level data combined from both EHRs and devices can be analyzed to produce individualized recommendations. For instance, a fitness app can propose a schedule for training, suggest the best time of day to do it, acknowledge the treatment plan, and provide feedback to encourage compliance.

Gaining clinical knowledge

Predictive analytics is the ability to anticipate the course of future events from large volumes of clinical and operational data.[21] More explicitly, prescriptive analytics helps identify new clinical knowledge by analyzing disease patterns and describing what course of action to take to elicit the maximum benefit when a predicted event does occur. AI algorithms can then suggest the optimal treatment by analyzing the patient's genetic makeup and clinical situation. These new capabilities will lead to more personalized medicine in which the specific drug regimen or treatment plan is determined by the patient's individual characteristics.

Researchers from Boston University studied how machine learning, a form of AI, can effectively predict heart disease and diabetes.[22] They were able to predict hospitalization due to each disease roughly a year in advance with an accuracy of 82%.[23] Being able to predict the future health state of a patient will help providers optimally tailor treatments to the individual before he or she experiences an adverse event.

To improve patient safety, algorithms are used as an early warning system that surveils for patient deterioration and triggers notification of real-time alerts. Data are pulled from a range of sources to pinpoint when a patient begins having trouble to proactively communicate risk warnings to clinicians. Fall risk scores can be combined with nurse call requests to enable timely alerts to be sent to mobile devices. The University of Arkansas for Medical Sciences reduced falls by 11% and fall-related injuries by 60% in its first year of sending bed exit notifications to clinicians on their mobile devices.[24]

Our charge is to integrate the human aspects of care while we automate reasoning processes.

Enhancing clinical decision support

Today, clinical decision support (CDS) is a tool commonly used within an EHR system to provide clinicians with knowledge to enhance their decision making. CDS is also used to provide alerts during order entry of allergies or contraindications to medications or treatments. As the use of AI becomes integrated with HIT systems, the advanced CDS guidance will be more patient- and context-specific by leveraging genetic and medical history data. Alerts can also be calibrated to clearly distinguish life-threatening problems from minor abnormalities. In this way, AI can potentially transform practice and drastically reduce the number of medical errors in diagnosis or treatment.

The power of AI can be used to empower and enable providers to make better decisions in areas where our brains need help. Anil Jain, MD, a medical informatics specialist at the Cleveland Clinic, says that we should think of AI as "augmented" intelligence: "It starts with data, but it ends with insights that transform the organization."[25] Drawing such insights will enable providers to improve the quality of care. By analyzing documentation using deep learning, AI can highlight certain clinical indicators in an EHR and alert when data are missing or need clarification.[26] This benefit of AI can contribute to quality improvement and support accurate coding for value-based reimbursement.

Improving efficiency

The power of AI can also be used to achieve more accurate diagnosis, prompt care, and greater efficiency. Virtual unlicensed assistive personnel are being leveraged through AI to augment clinicians, taking on tasks that lessen nurses' burden.[27] Such virtual assistants can interact with patients on a daily basis via a tablet or mobile phone, tracking vital signs using sensors and connected devices. AI solutions can remotely assess a patient's symptoms and deliver alerts to clinicians only when patient care is needed, enhancing prevention and reducing unnecessary hospital visits.[28] By leveraging these new capabilities, healthcare organizations can build a workforce and culture that will use AI to enhance workforce efficiency, quality, and patient outcomes.

The future

Nurses and our patients have much to gain from the use of AI. To take full advantage of these future advances, clinicians and informatics specialists must be involved and engaged at the outset to ensure that the systems are well-engineered and trusted. The future will be informed by data and the use of intelligent technologies that can take action based on information. We'll be able to deliver care better, faster, and safer if we appropriately harness the power of AI. Our charge is to integrate the human aspects of care while we automate reasoning processes. Converting volumes of data into decision-making models will require human oversight and intervention. With these safeguards in place, the future of augmented healthcare definitely looks promising. NM

REFERENCES

1. Adler-Milstein J, Jha AK. HITECH Act drove large gains in hospital electronic health record adoption. *Health Aff (Millwood).* 2017;36(8):1416-1422.
2. Merriam-Webster. Artificial Intelligence. https://www.merriam-webster.com/dictionary/artificial%20intelligence.
3. Neill DB. Using artificial intelligence to improve hospital inpatient care. *IEEE Intell Syst.* 2013;(28)2:92-95.
4. Sullivan T. Half of hospitals to adopt artificial intelligence within 5 years. www.healthcareitnews.com/news/half-hospitals-adopt-artificial-intelligence-within-5-years.
5. Lynch S. Andrew Ng: why AI is the new electricity. http://news.stanford.edu/thedish/2017/03/14/andrew-ng-why-ai-is-the-new-electricity.
6. Tufts J. Emerging impacts of artificial intelligence on healthcare IT. www.icetechnologies.com/blog/emerging-impacts-of-artificial-intelligence-on-healthcare-it.
7. Brynjolfsson E, Mcafee A. The business of artificial intelligence. https://hbr.org/cover-story/2017/07/the-business-of-artificial-intelligence.
8. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. *N Engl J Med.* 2003;348(26):2635-2645.
9. Latts L. The age of big data and the power of Watson. www.ema.europa.eu/docs/en_GB/document_library/Presentation/2017/01/WC500219353.pdf.
10. Chaudhry B, Wang J, Wu S, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med.* 2006;144(10):742-752.
11. Parente ST, McCullough JS. Health information technology and patient safety: evidence from panel data. *Health Aff (Millwood).* 2009;28(2):357-360.
12. Triotree. Artificial intelligence benefits and applications in healthcare. http://triotree.com/blog/artificial-intelligence-benefits-and-applications-in-healthcare.
13. Institute of Medicine. *To Err is Human: Building a Safer Health System.* Washington, DC: National Academies Press; 2000.
14. Kubuta T. Deep learning algorithm does as well as dermatologists in identifying skin cancer. http://news.stanford.edu/2017/01/25/artificial-intelligence-used-identify-skin-cancer.

15. Hart R. When artificial intelligence botches your medical diagnosis, who's to blame? https://qz.com/989137/when-a-robot-ai-doctor-misdiagnoses-you-whos-to-blame.
16. Wang J. Deep learning: an artificial intelligence revolution. http://research.ark-invest.com/deep-learning-white-paper.
17. Adams A. How artificial intelligence apps are changing patient engagement. www.beckershospitalreview.com/healthcare-information-technology/how-artificial-intelligence-apps-are-changing-patient-engagement.html.
18. Leventhal R. Artificial intelligence: the next frontier in health IT? (Part 1). https://www.healthcare-informatics.com/print/article/analytics/artificial-intelligence-next-frontier-health-it-part-1.
19. Stanford University. One hundred year study on artificial intelligence (AI100). https://ai100.stanford.edu.
20. Chan M. Opening remarks at the Artificial Intelligence for Good Global Summit. June 7, 2017. World Health Organization, Geneva, Switzerland.
21. Bresnick J. Turning healthcare big data into actionable clinical intelligence. https://healthitanalytics.com/features/amp/turning-healthcare-big-data-into-actionable-clinical-intelligence.
22. Bresnick J. Machine learning in healthcare: defining the most common terms. https://healthitanalytics.com/news/machine-learning-in-healthcare-defining-the-most-common-terms.
23. Dai W, Brisimi TS, Adams WG, Mela T, Saligrama V, Paschalidis IC. Prediction of hospitalization due to heart diseases by supervised learning methods. *Int J Med Inform.* 2015;84(3):189-197.
24. Knapp J. Five ways of effective use of alerts helps improve patient safety. https://www.hieanswers.net/five-ways-effective-use-alerts-helps-improve-patient-safety.
25. Weber DO. 12 ways artificial intelligence will transform health care. www.hhnmag.com/articles/6561-ways-artificial-intelligence-will-transform-healthcare.
26. Miliard M. Epic, Nuance embed AI into EHR for clinical documentation improvement. www.healthcareitnews.com/news/epic-nuance-embed-ai-capabilities-ehr-real-time-clinical-documentation-improvement.
27. Renouard G. Virtual medical assistant Molly helps patients manage chronic illness. https://atelier.bnpparibas/en/health/article/virtual-medical-assistant-molly-helps-patients-manage-chronic-illness.
28. Accenture. Artificial intelligence: healthcare's new nervous system. https://www.accenture.com/t20170418T023006Z__w__/us-en/_acnmedia/PDF-49/Accenture-Health-Artificial-Intelligence.pdf.

Joyce Sensmeier is the vice president of informatics for the Healthcare Information and Management Systems Society and a *Nursing Management* editorial board member.

The author and planners have disclosed no potential conflicts of interest, financial or otherwise.

DOI-10.1097/01.NUMA.0000526062.69220.41