Artificial Intelligence in Health Care

Educational Briefing for Non-IT Executives

Executive Summary

Artificial intelligence (AI) has been in development for decades and become a productive tool in many industries. While AI has received a tremendous amount of hype and hyperbole, advances in the availability of data for training, dramatically faster hardware, and maturation of the tools and algorithms are delivering radically better predictive models that are producing real, quantifiable impact within health care organizations. In particular, machine learning, a subset of AI, is becoming an essential part of advanced health system analytics programs. AI-enhanced processes can provide advantages in speed, cost, capacity, quality, and consistency, allowing human decision makers to focus on higher-value "top of license" tasks. The success of AI, as well as other advanced analytical techniques, depends on first building a mature conventional analytics program with a strong foundation in governance, culture, and skills.

What is Artificial Intelligence?

According to the *Oxford English Dictionary*, AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence. Machine learning, a closely related field, is a range of techniques that allow computers to learn to perform tasks without being explicitly programmed. At their core, machine learning algorithms work to identify patterns in data and create models that predict or classify specific outcomes. Taken together, artificial intelligence systems built using machine learning techniques are rapidly proving their ability to exceed human decision making at a wide variety of tasks.

AI capabilities can be broken down into Narrow AI and General AI. Narrow AI algorithms solve a tightly defined task such as finding pneumonia in an x-ray, but have no ability outside of that specific problem. General AI is a flexible intelligence that can understand context, quickly adapt to new situations, and apply knowledge learned from other domains. Most progress to date has been in Narrow AI.

Traditional Modeling v. Machine Learning

Traditional Modeling

Begins with a researcher proposing a hypothesis, which is then tested against data to see how well it predicts outcomes.

Machine Learning

Turns the process of generating and testing hypotheses over to an algorithm, which may be able to adapt to new data over time.

Common Applications

- Anomaly detection (outbreaks, operational breakdowns)
- Classification
- Predictive Estimates

The **less** the [statistician / programmer / researcher / analyst] has to determine the [order of processing data to use / populations to focus on / steps to improve the model] the more the system can be **described as intelligent.**

Why is it important?

Relative to human decision making, AI systems can provide advantages in speed, cost, capacity, quality, and consistency. AI enhances the abilities and efforts of human workers with its aptitude for handling repetitive tasks, processing large and complex data, and continuously monitoring operations. Through its ability to access vast troves of data, AI algorithms can exceed the knowledge of experts, or augment the abilities of non-experts. With these advantages in mind, it is important to note that AI still works best when paired with humans, as systems may not perform predictably when faced with parameters outside of their normal range of experience.

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Source: Health Care IT Advisor research and analysis.

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How is AI used or applied in health care?

Applications of Narrow AI to administrative decisions such as staffing levels and worklist prioritization are seeing the greatest adoption among health care organizations. For example, Mercy Hospital Fort Smith, in partnership with AI-enabled vendor Qventus, applies machine learning algorithms to improve emergency department patient flow by anticipating bottlenecks and capacity shortfalls. Qventus sends real-time notifications to care teams to trigger specific interventions, allowing Mercy Fort Smith to decrease their LWBS[1] rates and door-to-doc time by 30% and 20%, respectively. As the field grows comfortable with the maturity and risks associated with AI, numerous clinical applications will also benefit (e.g., medication dosing, radiology interpretation, and remote patient monitoring).

Examples of Current Areas of Application and Development

Intelligent Information Gathering and Sensing

What do we know about the patient and his changing environment to aid in his health?

Intelligent Interaction and Service

How can we communicate with our systems in a more natural manner?

Intelligent Diagnosis and Care Plans

What is wrong with the patient and what type of evolving treatment plan would be most effective?

Intelligent Medical Devices

How can we automate and adjust medical devices to be more real-time, accurate, and responsive?

Monitoring and Alerting

How can we identify when problems are developing and act before they become serious?

Advanced BI[2]/Analytics

What can we learn from our data, and how can we predict future states and act on that knowledge?

How does AI affect health care providers and IT leaders?

People and process considerations are critical to the success of AI integration. While IT may take the lead in AI initiatives, success relies on support from other leaders in the enterprise, particularly around issues concerning people and processes. To avoid implementation set-backs, health care organizations should do the following:

- **Explicitly tie AI projects to organizational strategy.** Clearly define intended outcomes and benefit mechanisms.
- **Consider the end-user experience**. Involve front-line staff in the design process. You will likely need to adjust workflows and monitor process performance as the application is tested and rolled out.
- **Ensure proper governance and monitoring are in place** to make certain the system functions as expected, and that a back-up plan is available if the AI agent ever needs to be disabled.
- **Pay close attention to new advancements** in AI**.** Providers and IT leaders should stay informed on what could be used, applied, or avoided within health care, as well as liability and ethical concerns.
- **Build your data platform maturity** to support AI technology. Models will only be as good as the data on which they are built. Acquire high-quality, well-governed data from cross continuum sources.

Questions That Hospital Executives Should Ask Themselves

1. Do we have the data and talent needed to execute on AI?
2. Should we be investing in AI ourselves, or should we look to our vendors?
3. Do we have a data-driven decision-making culture? Will we accept inconvenient truths?

Additional Advisory Board research and support available

Report: The Artificial Intelligence Ecosystem

Presentation: The Decision Machine: Analytics and the Rise of Artificial Intelligence

1) LWBS = Left without being seen.
2) BI = Business intelligence.

Source: Health Care IT Advisor research and analysis; https://qventus.com/content/uploads/2017/03/QVE-ED-Solution-Brief.pdf.

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