Overview of AI for Medical and Public Health Preparedness and Response

The Institute for Experiential AI
Northeastern University

The Roux Institute
Northeastern University

November 8th, 2023

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Northeastern University is the World Leader in Experiential Learning & Enterprise Collaboration

#53
Overall Ranking (out of 443 U.S. Universities)

#1
in Experiential Co-ops and Internship Programs*

#8
Most Innovative Universities*

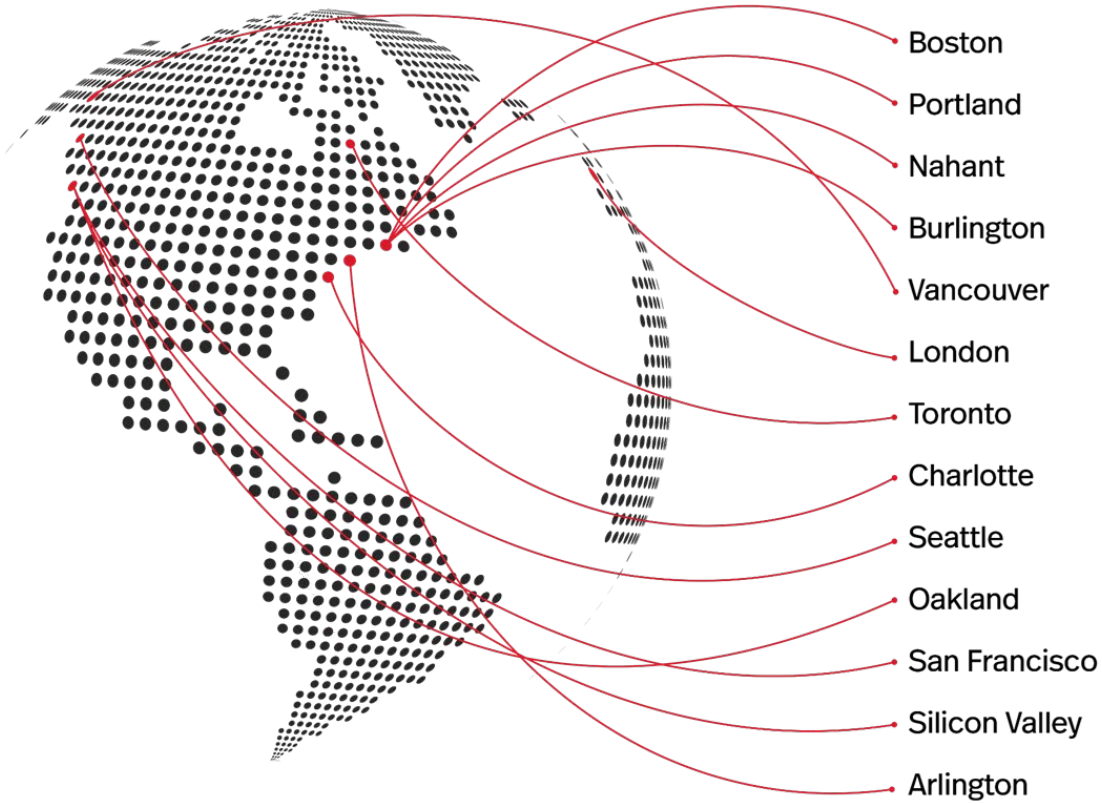
$230.7M+
External Research Funding

$1.5B+
Educational and Research Endowment

3,000+
Corporate Partners Across NU Worldwide Experiential Network

9
Interdisciplinary Institutes

Our Global University System



* US News and World Report 2024

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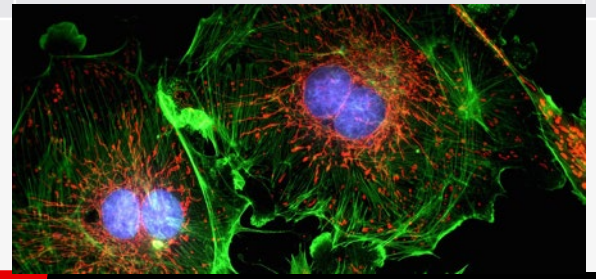
Strategic Digitization is one of the grand challenges facing us today

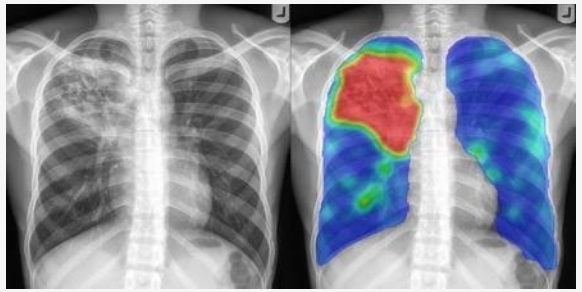
What Has Digital Transformation Looked Like in Health?
A tale of two illustrative journeys; Radiology vs. Pathology

- **Slower** *digitization and digitalization* than other fields
- Great advances in device tech – from diagnostics, surgical to imaging
- Interesting examples of inconsistent adoption of digital & AI

Some sample examples of uses of AI:

	Routine Medical Diagnostics	Cell Imaging	The Omics
✓	Radiology: digitized and a lot of automation	Great advances in technology down to sub-single-cell	Great advances in Genomics, Proteomics, and Transcriptomics
✗	Pathology: still in the land of analog and little AI processing	Very few large-scale uses	Very little work on combining omics and integrating metabolomics





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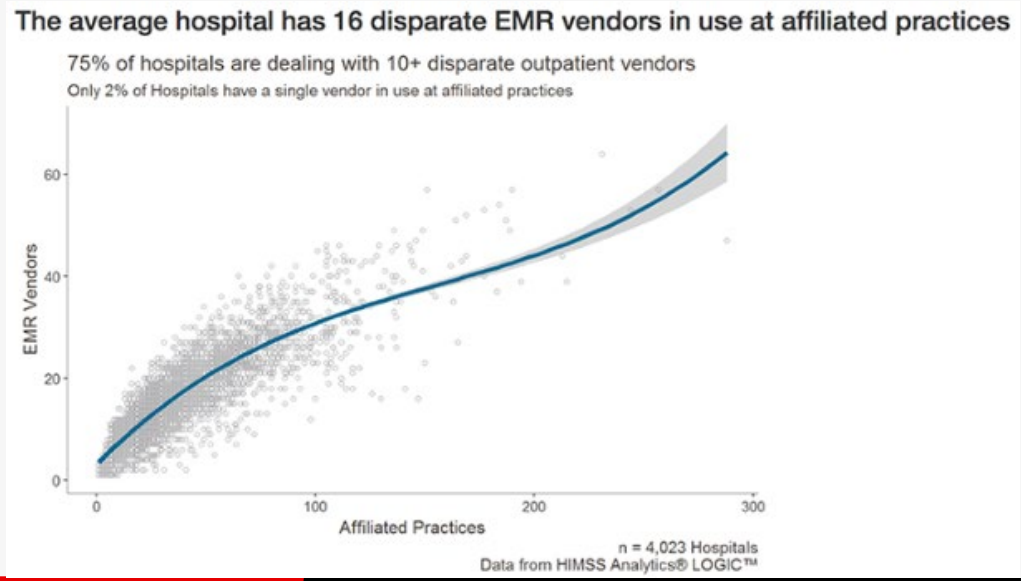
What About Electronic Medical Records?

- Mandated digital coding and medical notes
- Failure to standardize the Data
- No two EHR's look the same…
- Very fragmented space, and even the largest EHR systems do not inter-operate
- No real incentives to share data

This results in great difficulty to leverage AI/ML and automated analytics to help leverage the wealth of data

The average hospital has 16 disparate EMR vendors in use at affiliated practices Most hospitals have 10 EHR systems, and only 2% are down to only two EHR systems!



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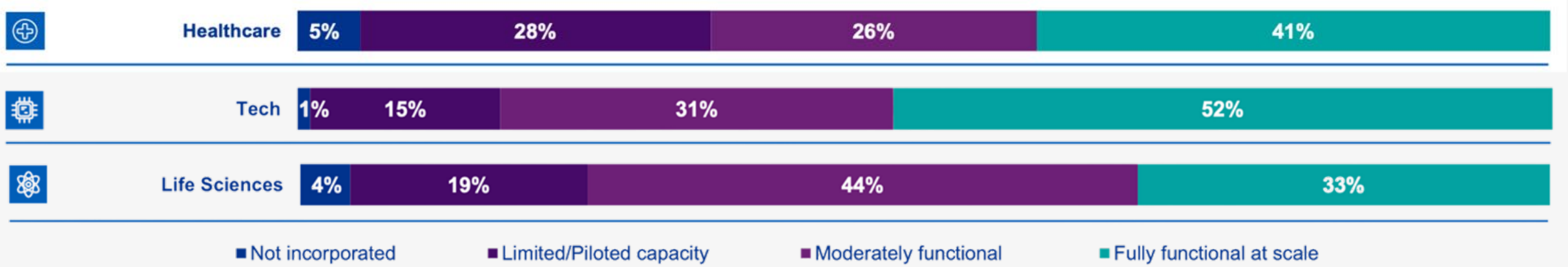
State of AI in healthcare and life sciences

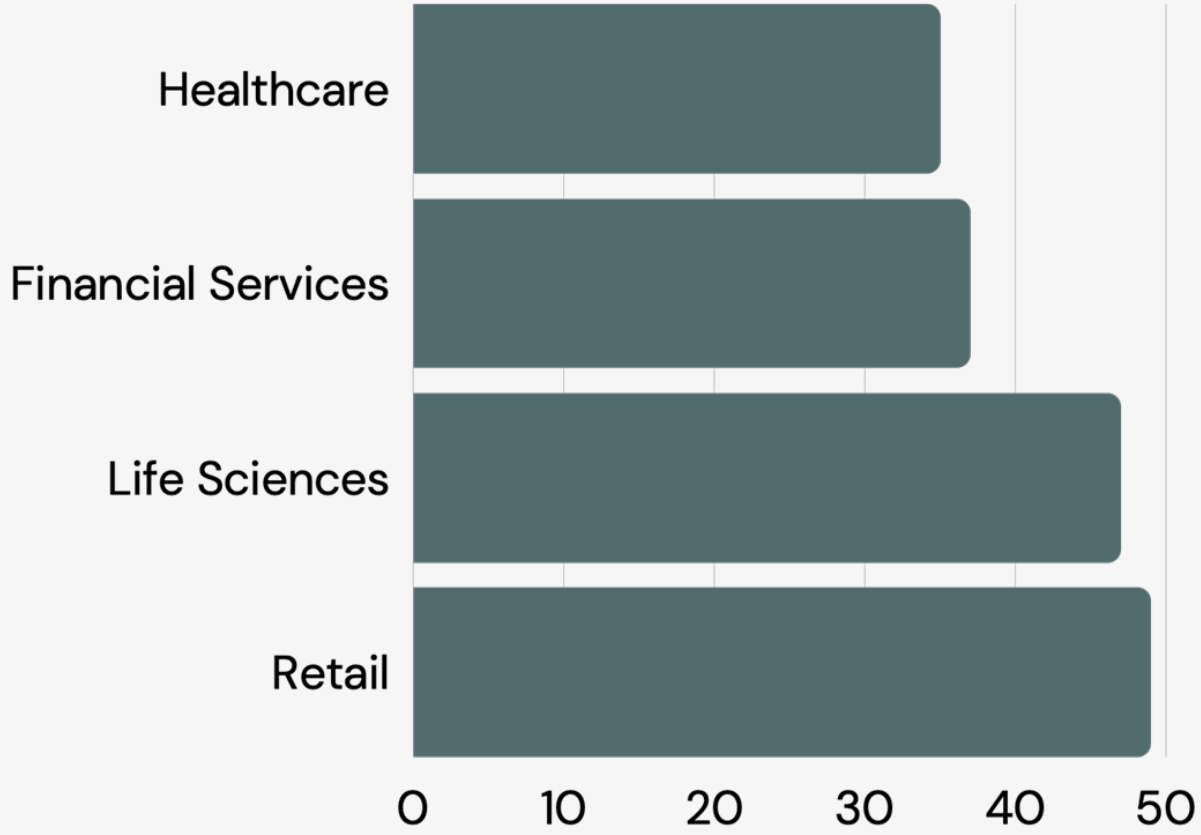
1. Poised to accelerate.



Source: KPMG 2021 *Thriving in an AI World* survey across 7 industries

State of AI in healthcare and life sciences

1. Poised to accelerate.
2. Concerns about the pace of adoption.

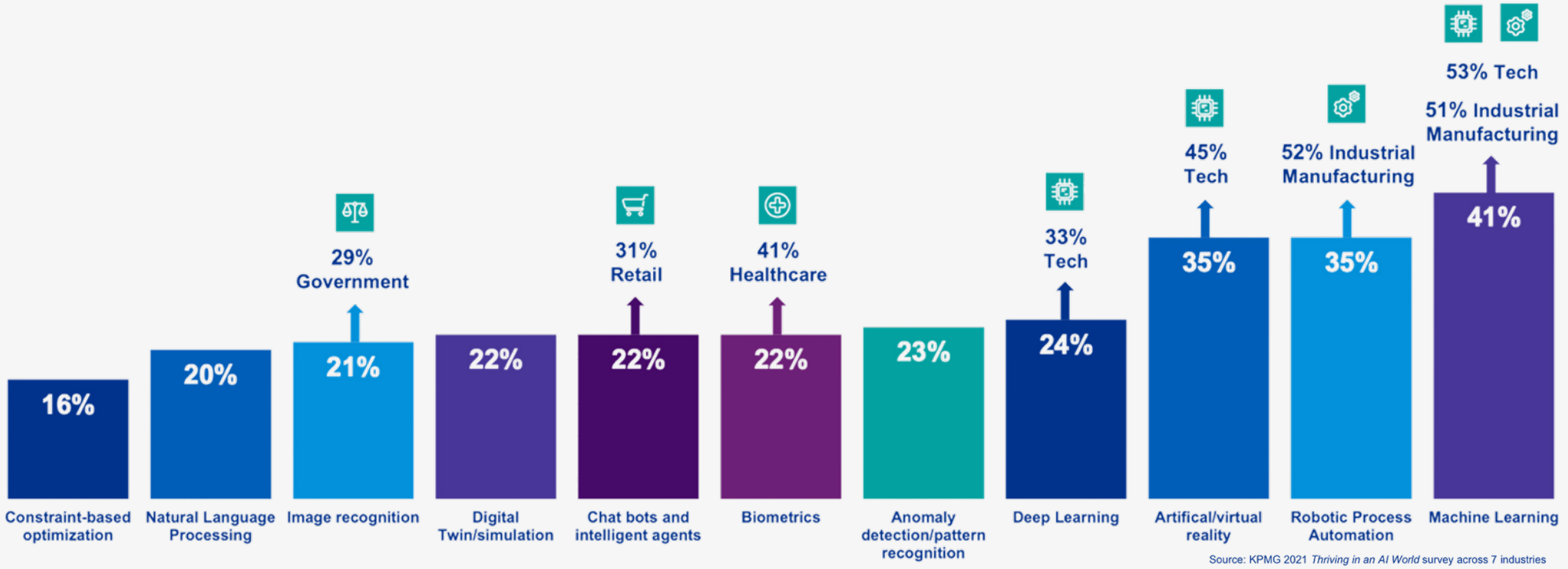


Percent of business leaders who think the pace of AI adoption in their sector is too fast.

Source: KPMG 2021 *Thriving in an AI World* survey across 7 industries

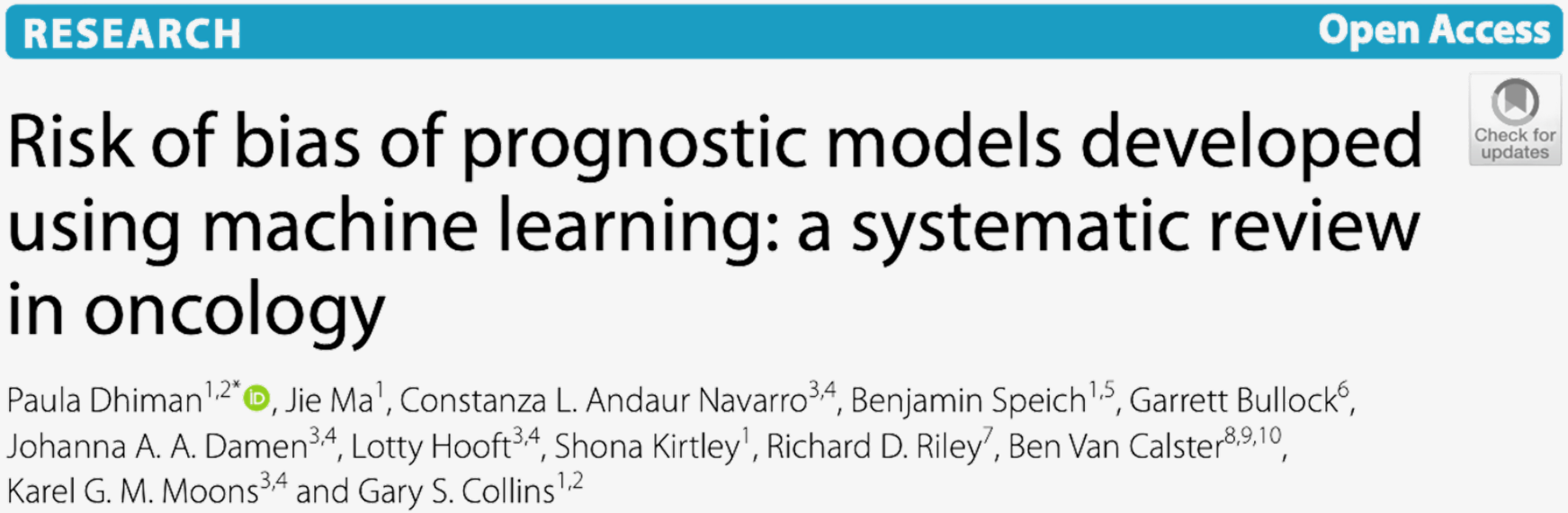
State of AI in healthcare and life sciences

1. Poised to accelerate.
2. Concerns about the pace of adoption.
3. Proliferation of tools and algorithms.



State of AI in healthcare and life sciences

1. Poised to accelerate.
2. Concerns about the pace of adoption.
3. Proliferation of tools and algorithms.
4. Concerns about cybersecurity, ethical use, and bias.



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Risk of bias of prognostic models developed using machine learning: a systematic review in oncology

Paula Dhiman[1,2*], Jie Ma[1], Constanza L. Andaur Navarro[3,4], Benjamin Speich[1,5], Garrett Bullock[6], Johanna A. A. Damen[3,4], Lotty Hooft[3,4], Shona Kirtley[1], Richard D. Riley[7], Ben Van Calster[8,9,10], Karel G. M. Moons[3,4] and Gary S. Collins[1,2]

State of AI in healthcare and life sciences

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5. Investors are less experienced and decisions are complex.

Around 85% of biotech investors have been working in the field for less than a decade, according to an Omega Funds tally

BIOTECH

STAT+

VC deals and valuations begin falling apart amid biotech's stock shock

By Allison DeAngelis July 5, 2022

Reprints

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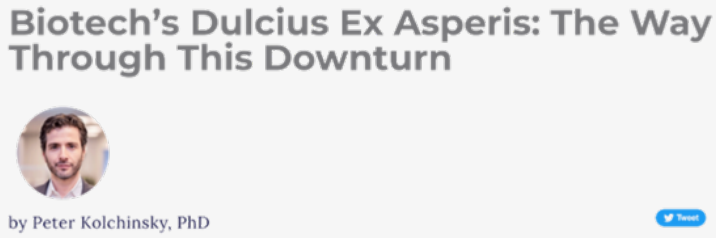
And on top of all that, biotech is just so technically complex. Investing legend Peter Lynch advised everyone to invest in a well-researched subset of "what you know." That pretty much nixes biotech for the vast majority of investors, even professionals.


Biotech's Dulcius Ex Asperis: The Way Through This Downturn

by Peter Kolchinsky, PhD

State of AI in healthcare and life sciences

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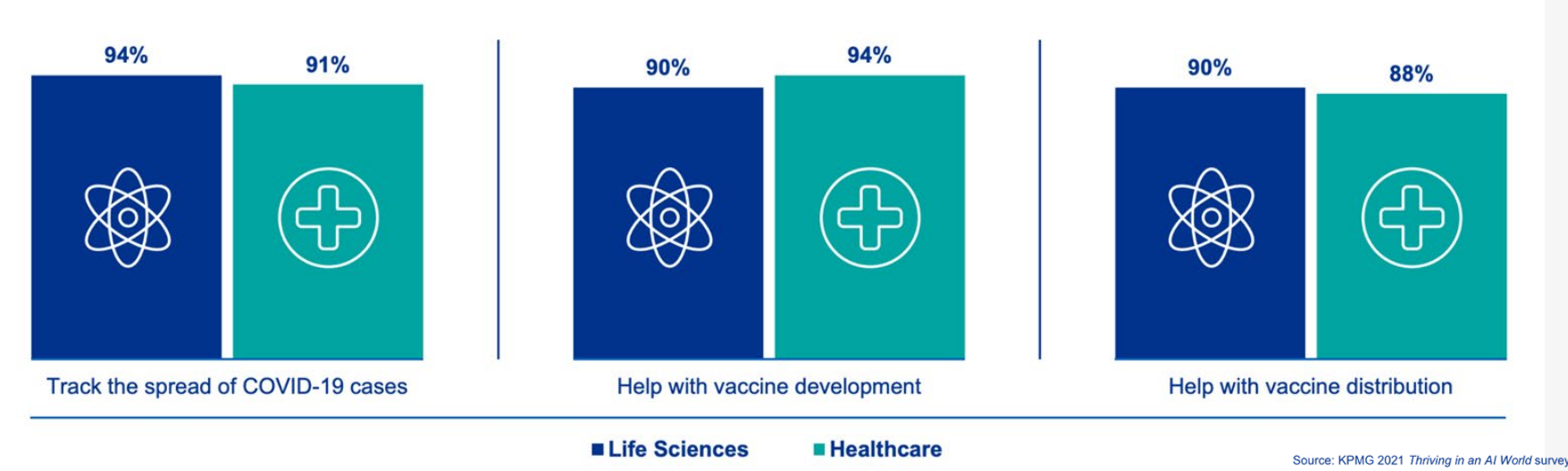
6. Enthusiasm for AI's ability to improve public health



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KPMG

Biggest opportunities for AI in healthcare/public health

Drug discovery

- Identifying novel biomolecules.
- Toxicity prediction.
- Smart trial design/enrollment.
- Drug repurposing and novel combinations.

Diagnostics

- Integration of multi-omics data to improve diagnostics.
- Partition of diseases based on biomarkers.
- Earlier detection of disease and progression.

Early warning systems

- AI applied to environmental (e..g, wastewater) surveillance.
- Integration of mobility data with healthcare-facility-level information.
- Federated learning across jurisdictions.

Process Optimization

- Bioinformatic pipeline development.
- Pathogen risk stratification.
- Literature review and synthesis.
- Form completion/reporting.

Misinformation

- Identification of mis/disinformation.
- Chatbots for public health/healthcare messaging.
- Reliable search for real-time, accurate information on outbreaks/risks.

Situational Awareness

- Automated data integration.
- Enhanced forecasting capabilities.
- Multi-pathogen wastewater surveillance.
- Screening for AMRs and other resistance markers.

How do we get started?

- Build a community around standards.
  E.g., Build ontologies/ schema, common data models, APIs, etc..
- Leverage ML/ AI (human-in-the-loop) for integrating data.
- Federated data models, including computing infrastructure.
- Legal and ethical frameworks.
- Multi-stakeholder engagement around technology/ data needs.
  E.g., Ambiant intelligence, cloud<->edge computing, etc.
- Training for the next generation of health data researchers and policy-makers.
  E.g., NIH Fogarty RAPIDD 2.0? Program targeted at policy-makers?

Learn more about AI at Northeastern University!

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SCAN ME!