Transforming healthcare: Biomedical Informatics and Artificial Intelligence

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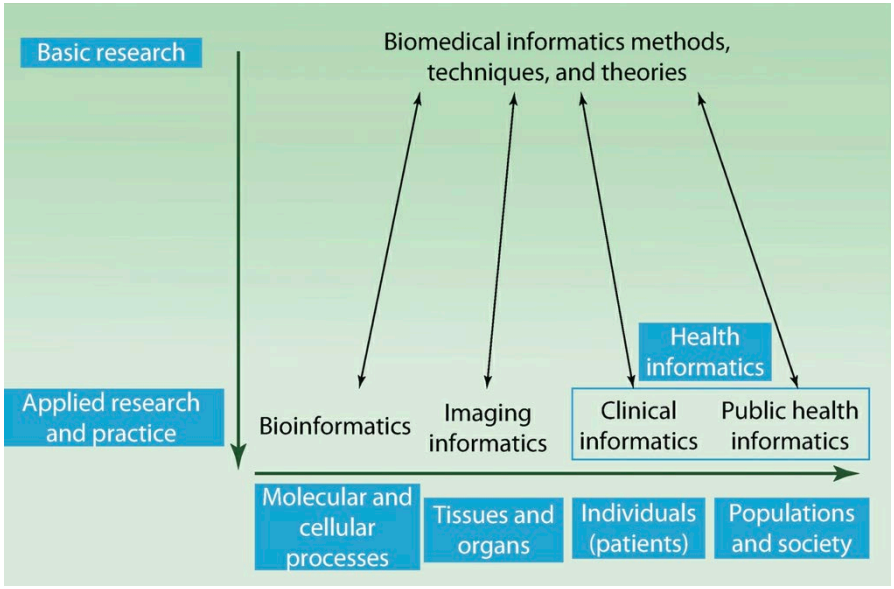
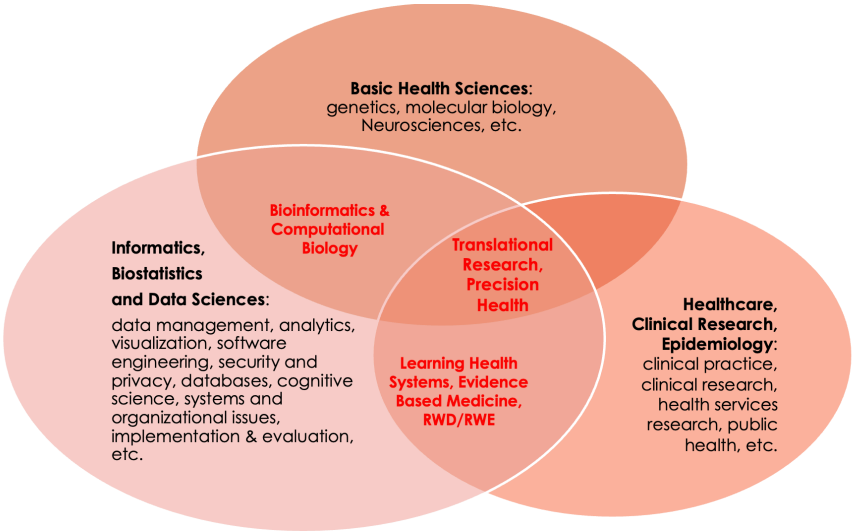
What is biomedical informatics?



Shortliffe, Cimino, Chiang.
Biomedical Informatics. 2021

Sub-domains of **Biomedical Informatics** exist at the intersections of informatics and health/biomedical content domains.



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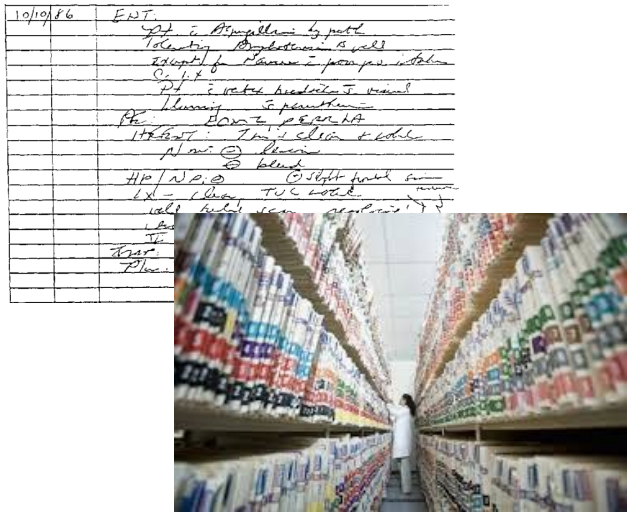
The EHR journey



Paper charts
Illegible and unstructured
No cognitive support
No opportunity for learning
Difficult to find information
Missing resources, records
Centralized

Electronic Medical Records
Mostly structured data
Missing records
Little cognitive support
No easy summarization
Screens, clicks
Increased documentation
Not “child friendly”

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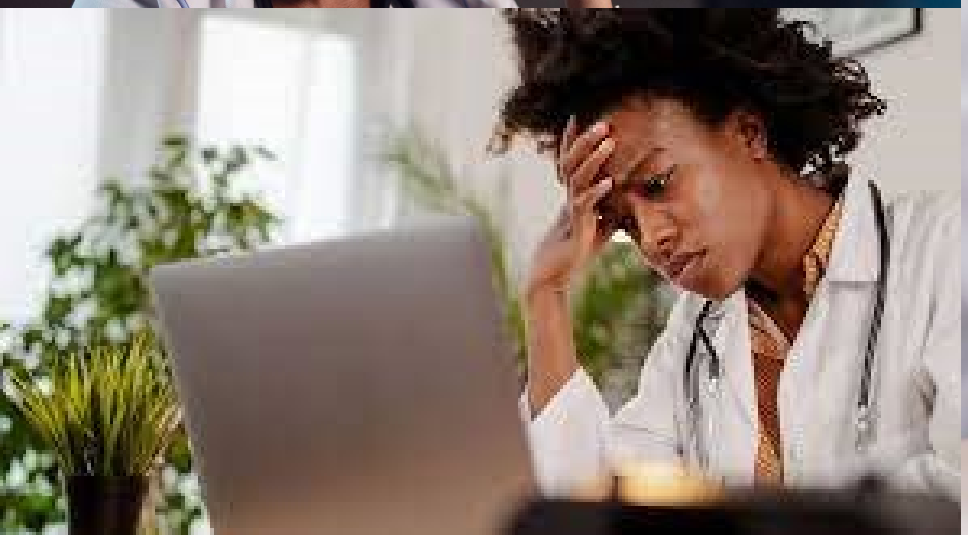
The current EHR

- Expanded, new functionalities
- Decision support
- Care coordination
- Integration of genomics data
- Patient portals

- Laborious and sub-optimal documentation
- Difficult chart review
- Poor ergonomics, poor usability
- Inefficient support to workflows
- Not much innovation in pediatrics
- Limited computable data
- No much innovation in pediatrics



Meanwhile....

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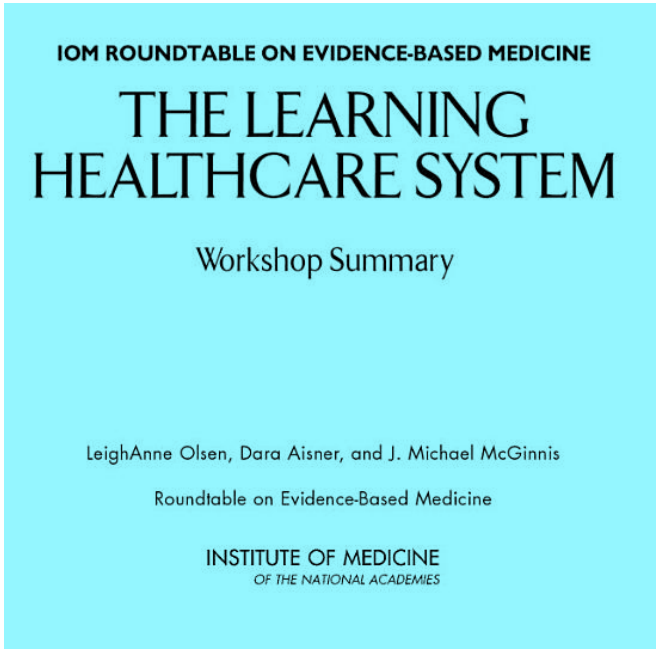
Envisioning the future…

- Comprehensive and equitable health care for all children
  - Bias, representative cohorts, dissemination, access, global reach
- Reduction of morbidity and mortality and increase quality of care worldwide
  - Predictive models, intelligent surveillance
- Rethinking the EHR:
  - Digital environment that facilitates patients and families to actively engaged in care
  - Empowered clinicians supported by smart, intuitive and ubiquitous technology (stressless)
  - Hub for multi-source data
  - Reduce manual documentation efforts

IOM Insights

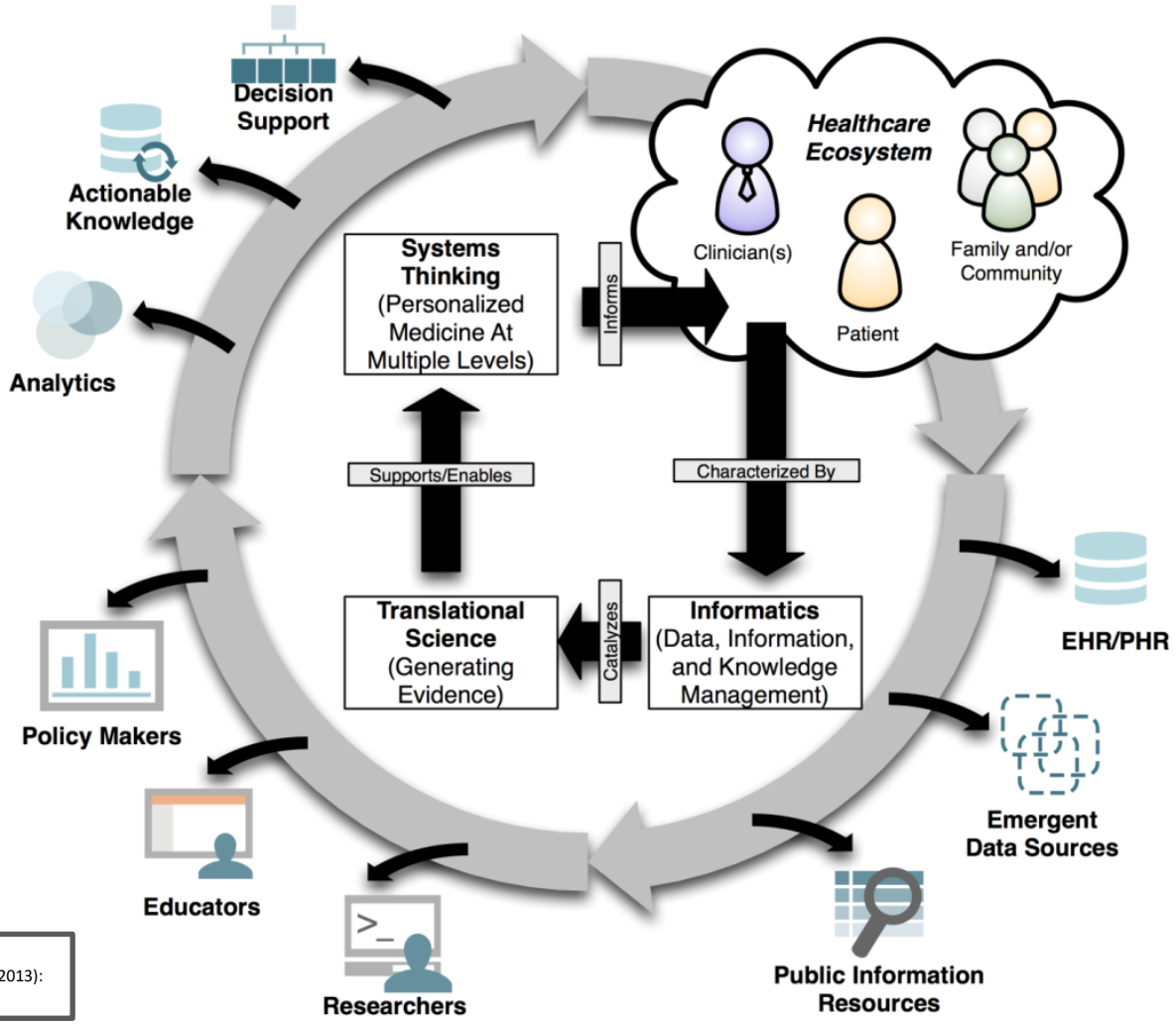


"…to accommodate the reality that although professional judgment will always be vital to shaping care, the amount of information required for any given decision is moving beyond unassisted human capacity."

Institute of Medicine (IOM). 2007. page 5, *The Learning Healthcare System: Workshop Summary*

Leveraging Informatics to Create a Learning Health System

1) Studying linkages between molecules and populations
2) Developing tools and methods to better enable Evidence generation and application
3) Building bridges to the health system – point-of-care, persons
4) Implementing and studying solutions in the healthcare environment, working with IT in order to do so



Embi, Peter J., Payne, Philip R.O. *"Evidence generating medicine: redefining the research-practice relationship to complete the evidence cycle."* *Medical care* 51 (2013): S87-S91.

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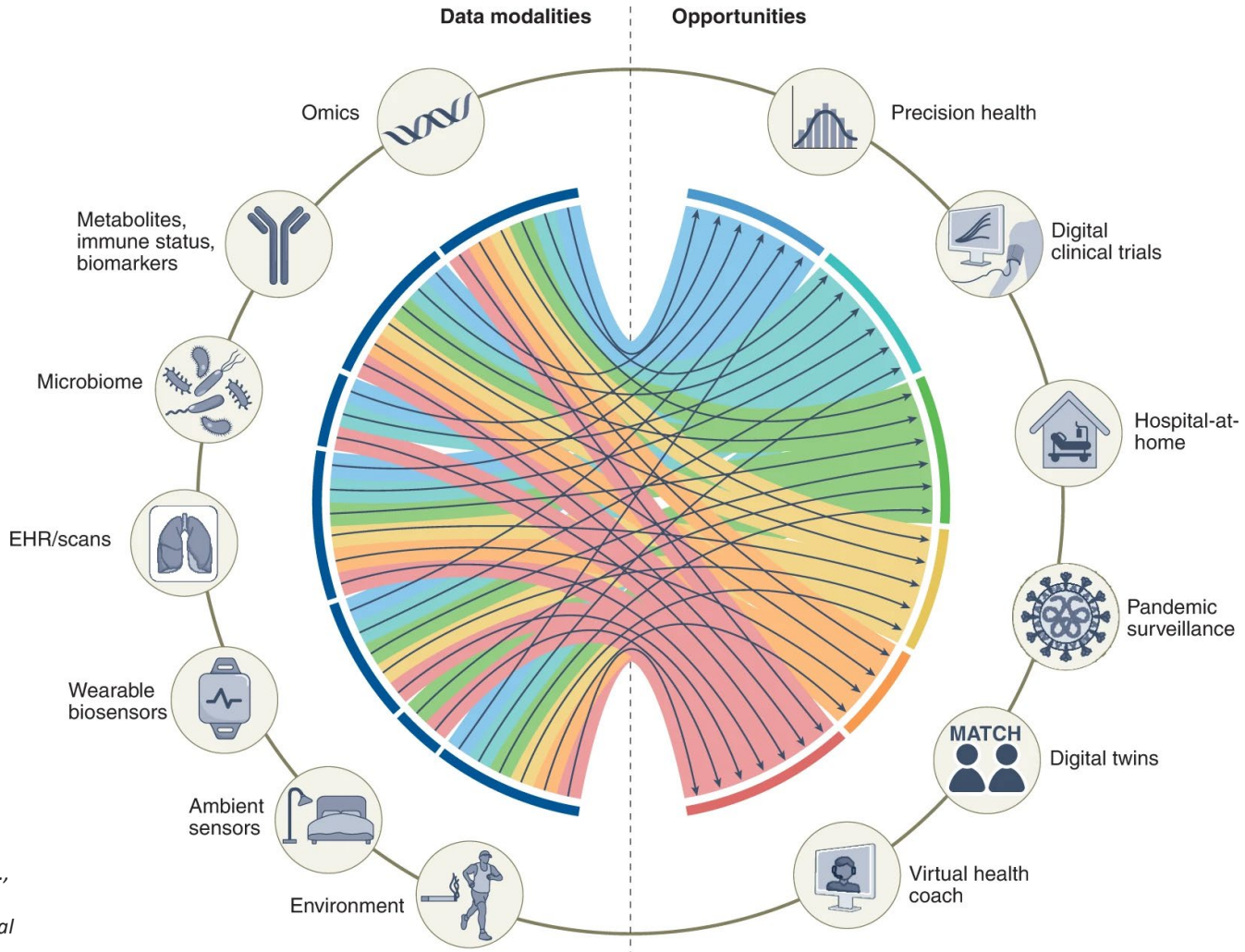
Data modalities and opportunities



*Acosta, J.N., Falcone, G.J., Rajpurkar, P. et al. Multimodal biomedical AI. Nat Med **28**, 1773–1784 (2022). https://doi.org/10.1038/s41591-022-01981-2*

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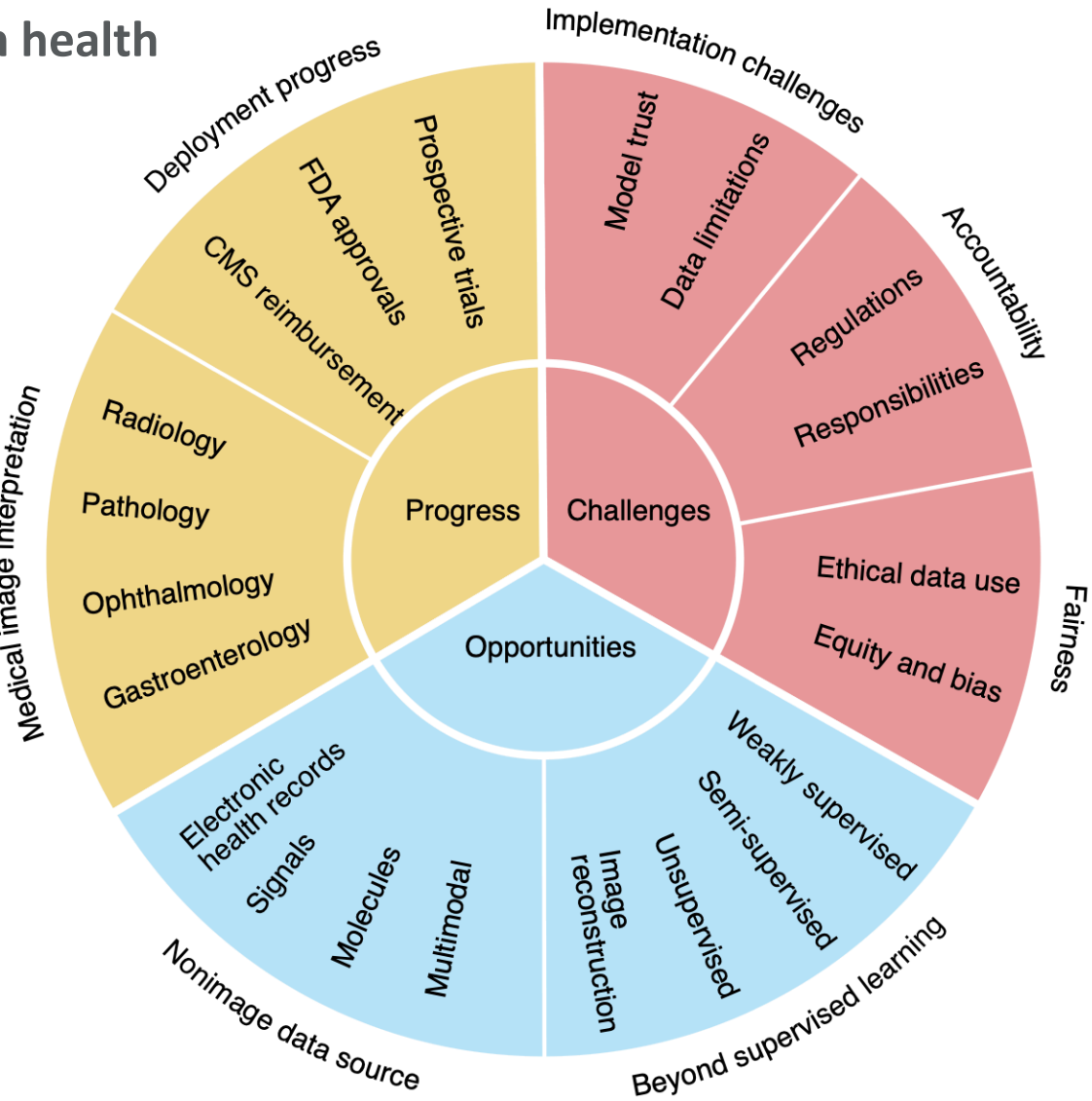
Progress, challenges and opportunities for AI in health



AI in health and medicine
Rajpurkar, Pranav; Chen, Emma; Banerjee, Oishi ; Topol, Eric J.
Nature medicine, 01/2022, Volume 28, Issue 1

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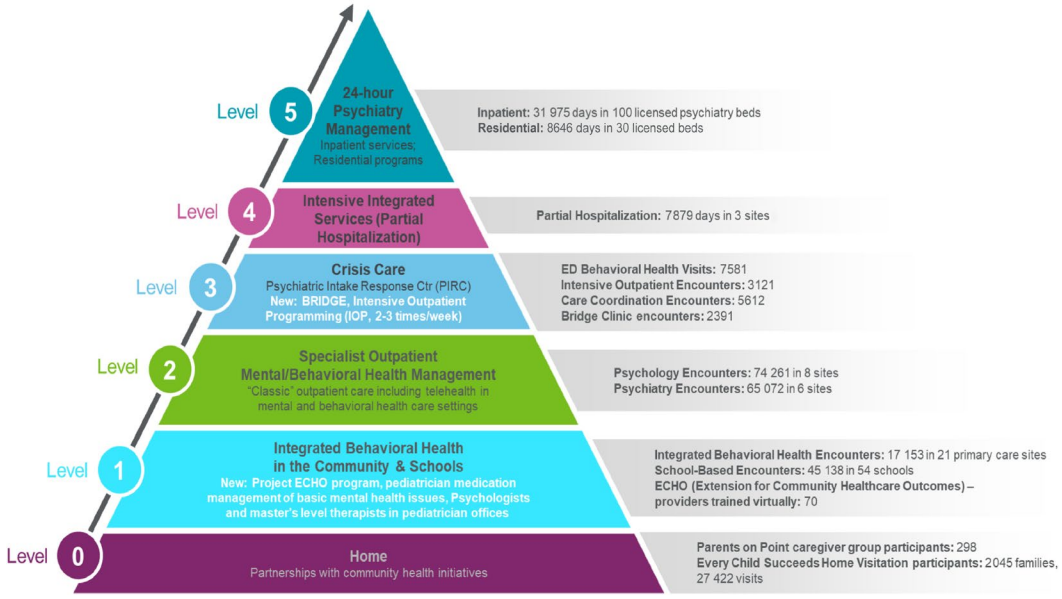
AI innovations

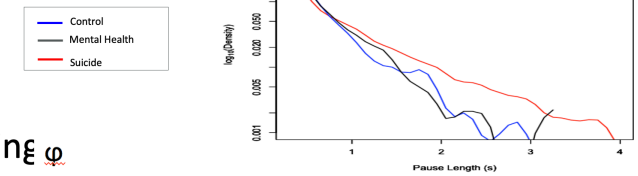
Cincinnati children's mental health system of care framework (FY22 numbers).



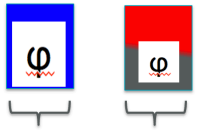
Sorter, M., et al.. (2023). *The Journal of Pediatrics*, 113479

T_m Audio Features Study

- Pauses
  - Longer



- Vowel Spacing φ
  - The suicidal language has different vowel space



Venek, V., et al. DecemberIn 2014 IEEE Spoken Language Technology Workshop (SLT) (pp. 277-282). IEEE.

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Effective use of AI

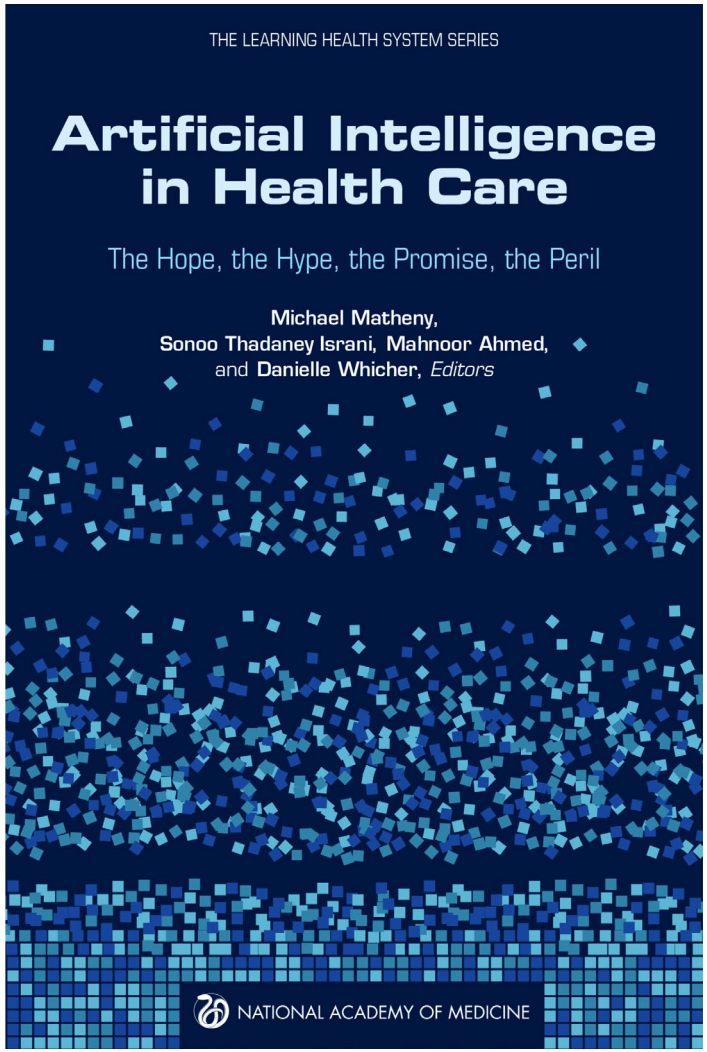
- opportunity for thoughtful engagement
- few examples of AI deployment and use within the health care delivery system
- sparse evidence for improved processes or outcomes when AI tools are deployed
- need to adhere to best practices for the form, function, and workflow placement of CDS
- health system reimagined as a dynamic system

Where? How? When?

- Clinical information processing and management
- Enterprise operations
- Nontraditional health care settings
- Population health management
- Patient- and caregiver-facing applications
- Applications in clinical care delivery
- Risk prediction, clinical decision support

Multi-disciplinary approach

- IT capabilities
- Data environment
- Interoperability
- Education and workforce Development
- Patient, family, consumer engagement
- Ethics and fairness
- Safety and efficacy
- Regulations
- Cost, revenue, and value



"AI in health care is poised to make transformative and disruptive advances in health care. It is prudent to balance the need for thoughtful, inclusive health care AI that plans for and actively manages and reduces potential unintended consequences, while not yielding to marketing hype and profit motives. The wisest guidance for AI is to start with real problems in health care, explore the best solutions by engaging relevant stakeholders, frontline users, patients and their families—including AI and non-AI options—and implement and scale the ones that meet our Quintuple Aim: better health, improved care experience, clinical well-being, lower cost, and health equity throughout.

National Academy of Medicine (NAM) 2019. page 5. Artificial Intelligence in Health Care.