Digital Professionalism, Artificial Intelligence and YOU

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Structures
NETWORK
Managed
CARE
Healthcare

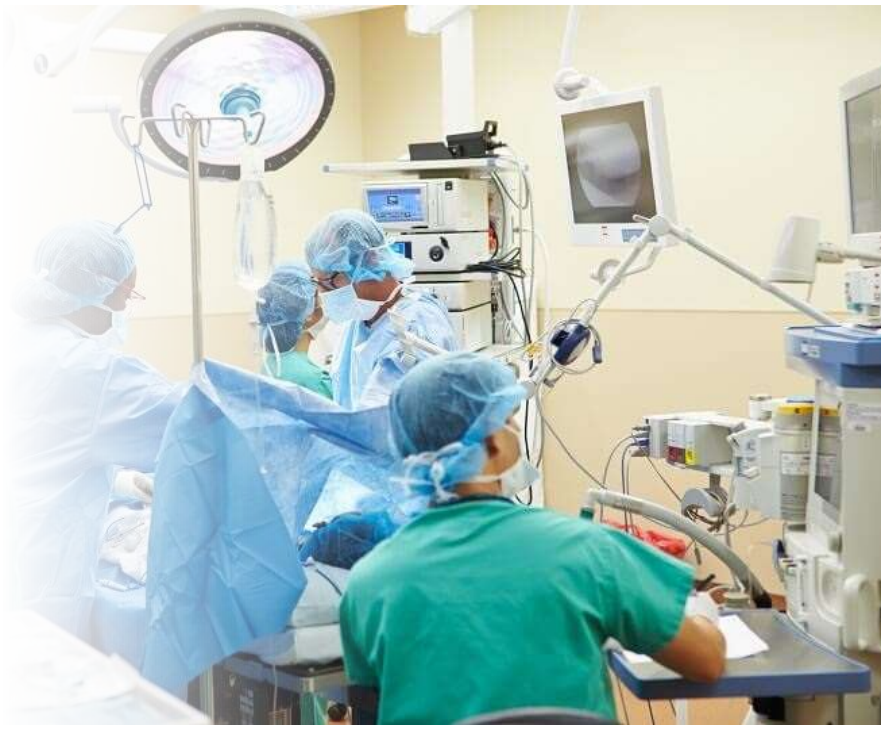
The demise of physician authority and the de-mystification of the clinician – patient relationship

- Health care becomes commodified and competitive in the interests of increased revenues and efficiency;
- Media reports of medical errors, corporate greed, seemingly heartless denials of insurance coverage increase distrust of organized medicine and their personnel;
- Competition among physician groups and their physician extenders for securing reimbursement: who should be doing what?
- The rise of upper and mid-level non-physician management and their usurping the power of physicians in the interests of corporate's concerns about achieving "productivity targets"

But health professionals still did OK reputation-wise: Maybe we distrusted organized medicine, but we continued to trust our own private doctors and nurses.

Why?

- Because clinicians still exerted control over clinical interventions
- The technology kept getting increasingly sophisticated but it didn't replace the physician, nurse or therapist from performing their clinical, interventionist functions.

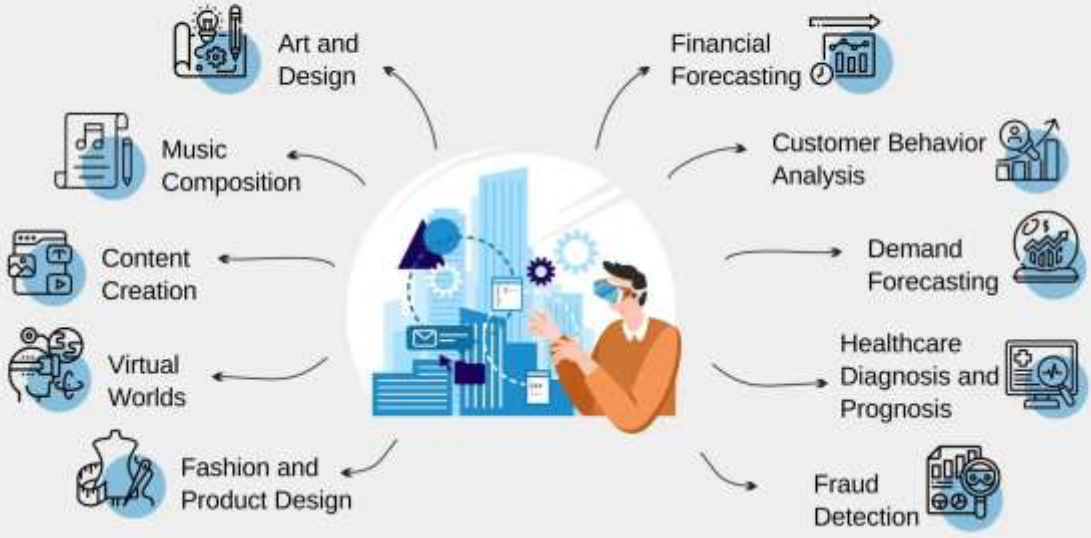


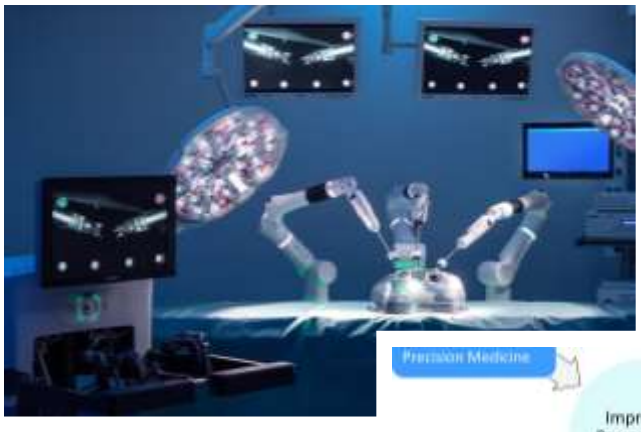

AI

What is AI?

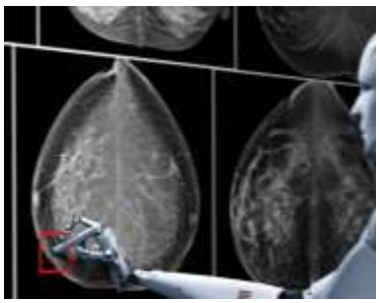
Generative AI Applications

Neebal Technologies
www.neebal.com

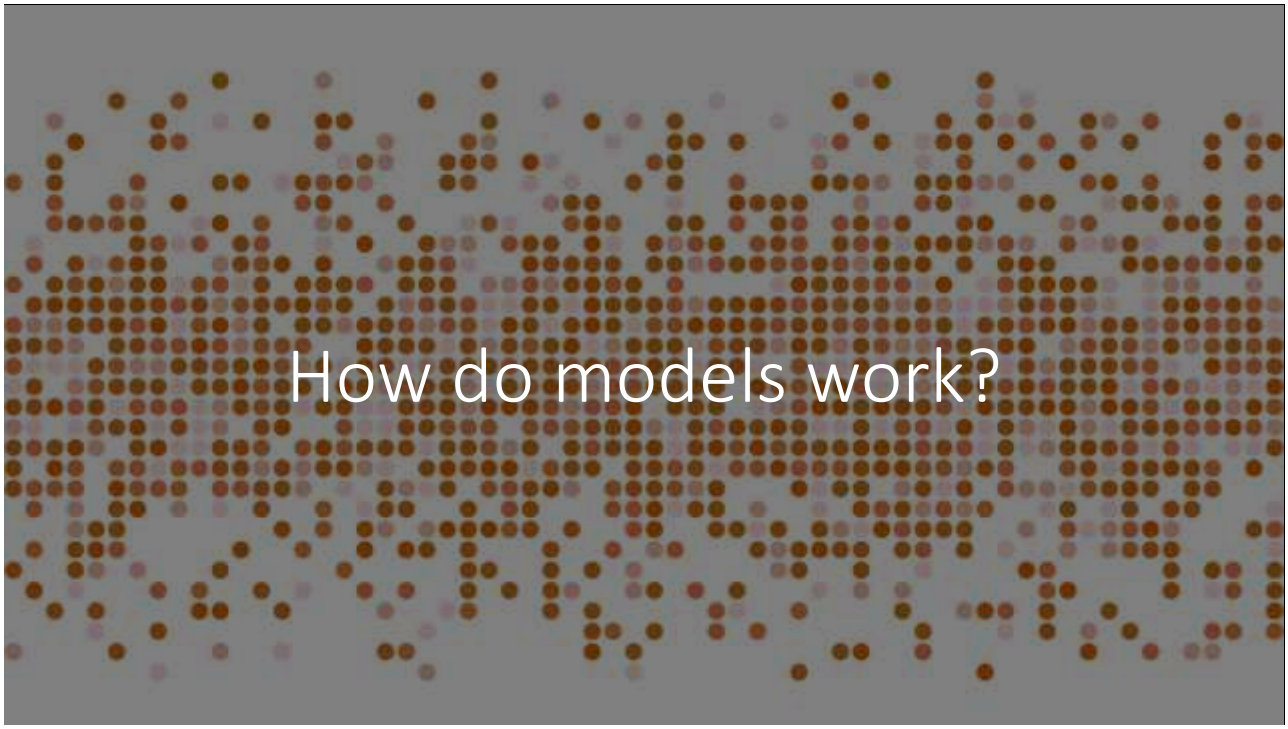


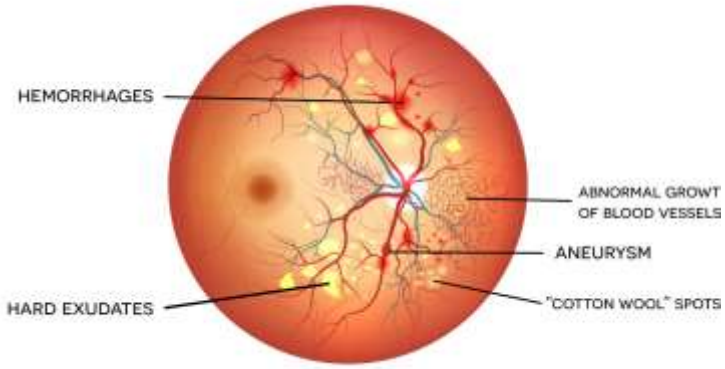



Home
Cloud Service
Healthcare Unit
Measurement Device
Patient
interacts




Precision Medicine
Artificial Intelligence
Improving Personalized Care
Therapy Planning
Genomic Considerations
Social Determinants of Health
Risk Prediction or Diagnosis
Genomic Considerations


How do models work?



Diagnosing Diabetic Retinopathy

- Numerous researchers have validated MLCs on DR;
- Ting et al used 494,661 retinal images with 76,370 DR images and the rest spread across glaucoma, AMD and normal; Gulshan et al used 118,419 images: 53,759 normals and 64,660 DR;
- Gulshan's accuracy was 0.990-0.991 for detecting referable DR with sensitivity and specificity for referable DR over the two data sets at 0.870-0.903 and 0.981-0.985

"Deep Learning at Chest Radiography: Automated Classification of Pulmonary Tuberculosis by Using Convolutional Neural Networks," Paras Lakhani and Baskaran Sundaram, Radiology, 2017; 284(2):574-582.

- "The best performing classifier had an AUC of 0.99, which was an ensemble of the AlexNet and GoogLeNet DCNNs…Deep learning with DCNNs can accurately classify TB at chest radiography with an AUC of 0.99. A radiologist augmented approach for cases where there was disagreement among the classifiers further improved accuracy."

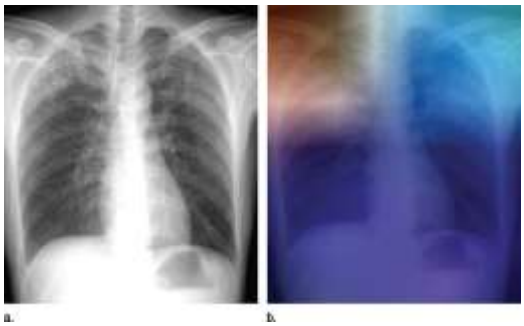


Figure 4: (a) Posteroanterior chest radiograph shows upper lobe opacities with pathologic analysis–proven active TB. (b) Same posteroanterior chest radiograph, with a heat map overlay of one of the strongest activations obtained from the fifth convolutional layer after it was passed through the GoogLeNet-TA classifier. The red and light blue regions in the upper lobes represent areas activated by the deep neural network. The dark purple background represents areas that are not activated. This shows that the network is focusing on parts of the image where the disease is present (both upper lobes).

DEEP PATIENT

- Miotto, R. *et al*. Deep Patient: An Unsupervised Representation to Predict the Future of Patients from the Electronic Health Records. *Sci. Rep.* **6**, 26094; doi: 10.1038/srep26094 (2016).

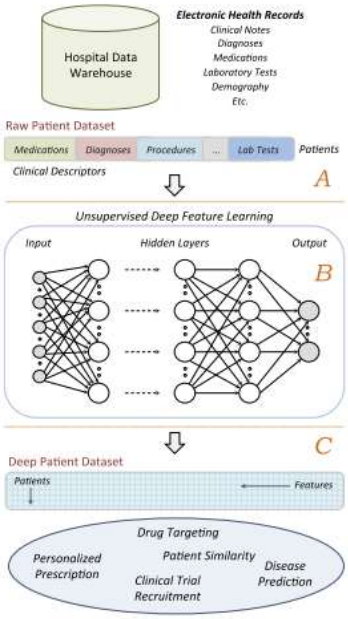


Figure 1. Conceptual framework used to derive the deep patient representation through deep learning of a large EHR data warehouse. (A) Pre-processing stage to obtain raw patien from the EHRs. (B) The raw representations are modeled by the unsupervised deep architectu of general and robust features. (C) The deep features are applied to the entire hospital databas representations that can be applied to a number of clinical tasks.

What's Deep Patient?

- Using patient data from the hospital data warehouse to predict diseases that might develop
- The training set included ~1.6 million patients treated between 1980 and 2013 (Mt. Sinai, NY)
- The test set included 100,000 patients in 2014 evaluating 79 diseases based on ICD-9 codes, e.g., endocrinology, cardiology, and oncology

Time Interval = 1 year (76,214 patients)			
	Area under the ROC curve		
Disease	RawFeat	PCA	DeepPatient
Diabetes mellitus with complications	0.794	0.861	0.907
Cancer of rectum and anus	0.863	0.821	0.887
Cancer of liver and intrahepatic bile duct	0.830	0.867	0.886
Regional enteritis and ulcerative colitis	0.814	0.843	0.870
Congestive heart failure (non-hypertensive)	0.808	0.808	0.865
Attention-deficit and disruptive behavior disorders	0.730	0.797	0.863
Cancer of prostate	0.692	0.820	0.859
Schizophrenia	0.791	0.788	0.853
Multiple myeloma	0.783	0.739	0.849
Acute myocardial infarction	0.771	0.775	0.847

- "The results were compared with other (predictive) techniques such as raw EHR, principal component analysis (PCA), k-means, and generalized method of moments (GMM) analysis – and it outperformed them all, producing an area under the curve (AUC) of 0.79 versus the other methods."

Results

A Primary Care (AI) Office Visit in the Future (10 - 20 years?)

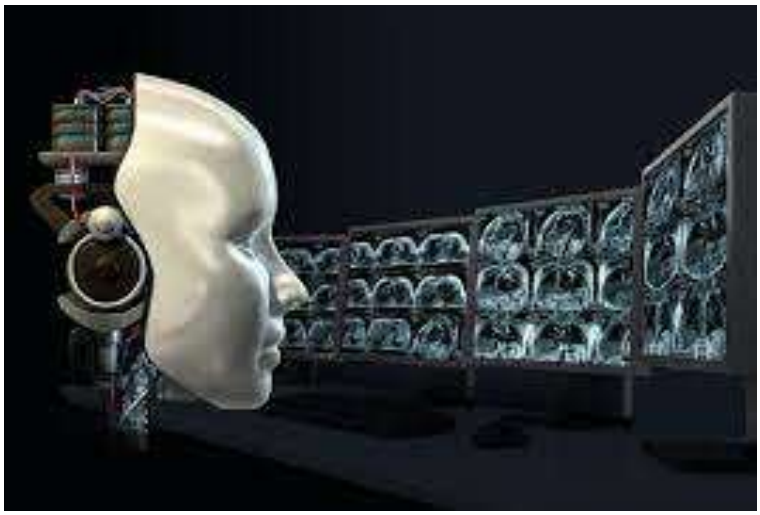
- ***SYMPTOMS + TESTS***
- **FAMILY HISTORY + PATIENT HISTORY**
- **PATIENT'S DNA**
- **ELECTRONIC MEDICAL RECORDS**
- **REVIEW DIFFERENTIAL DIAGNOSES AND RECOMMENDATIONS DECISION(S) THROUGH PUB MED DATABASES**

OUTPUT

Machine learning applications will only be limited by the imaginations of programmers, their knowledge base (which might be enhanced by AI itself!), and the physical/chemical limitations of their technologies.

So what does this mean for YOU?

#1: The De-skilling Threat

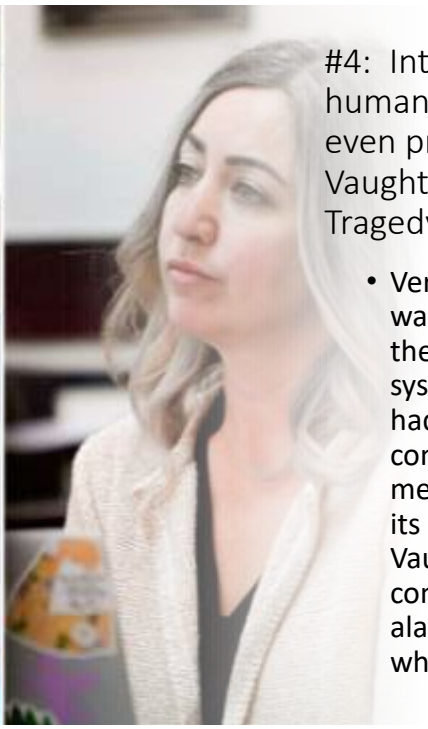


AI and all the Imaging Sciences: The Threat of “Deskilling” from an automation bias.

#2: Legal Liability?

- In the instance of disagreement with an AI model, how should the human clinician proceed, especially with an eye to protecting his or her liability?
- Notice: If you follow it or if you override it and there's a bad outcome, you might be sued either way.
- How to understand your obligation to the patient under such threat?

#3:
Healing as a derivative of the geographical and psychological proximity of clinician to patient. Will digital technologies encourage that loss?

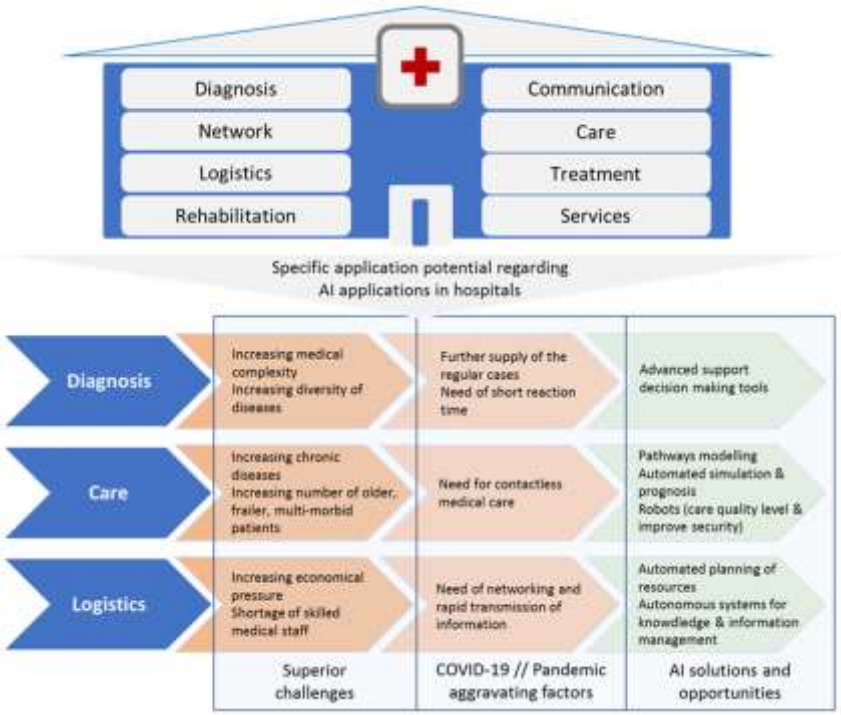


#4: Integration of AI and humans: Would AI have even prevented the Vaught/Murphey Tragedy?

- Very likely, but the hospital was having trouble with their medication ordering system, which is why Vaught had to go to another computer to get the medicine and then override its alarms. Nurses at Vaught's hospital were commonly overriding alarms. What happens when systems go down?


#5: Clinical Education of the Future

#6: The Transition to AI Technologies Will Not be Smooth

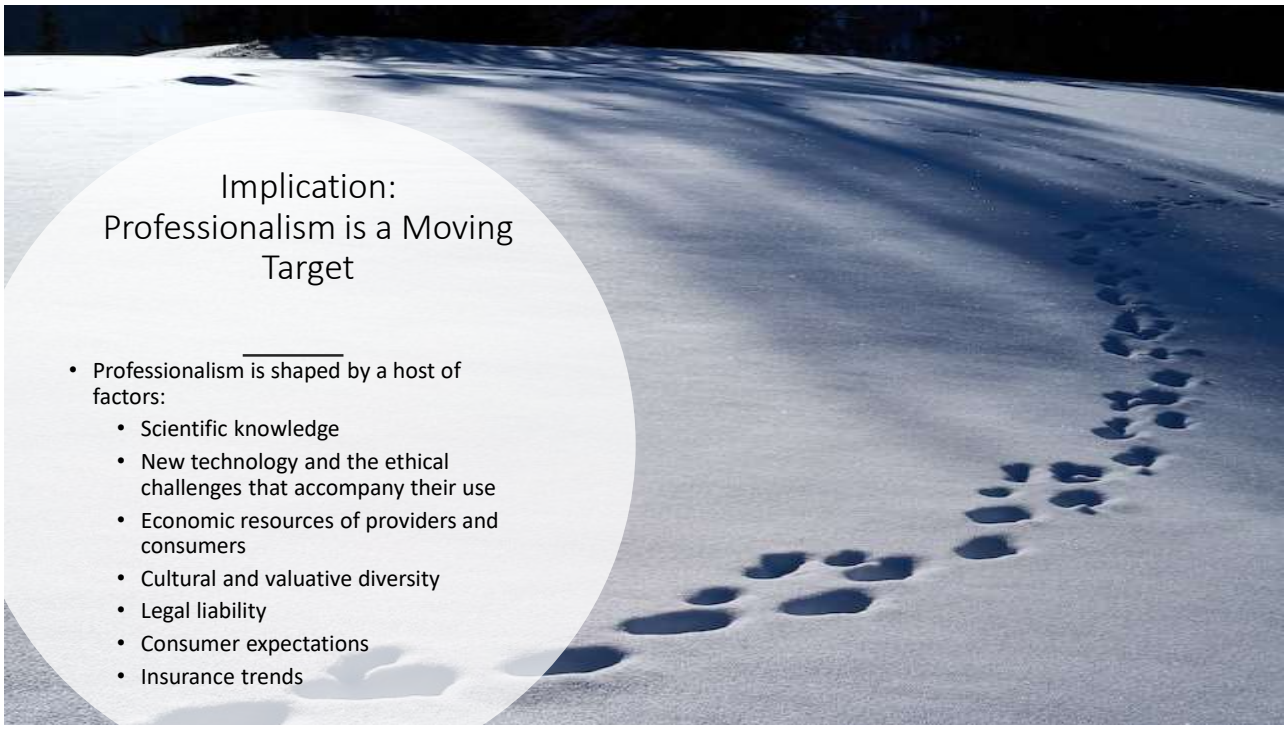

Diagnosis
Network
Logistics
Rehabilitation
Communication
Care
Treatment
Services
Specific application potential regarding
AI applications in hospitals
Diagnosis
Care
Logistics
Increasing medical complexity
Increasing diversity of diseases
Increasing chronic diseases
Increasing number of older, frailer, multi-morbid patients
Increasing economical pressure
Shortage of skilled medical staff
Further supply of the regular cases
Need of short reaction time
Need for contactless medical care
Need of networking and rapid transmission of information
Advanced support decision making tools
Pathways modelling
Automated simulation & prognosis
Robots (care quality level & improve security)
Automated planning of resources
Autonomous systems for knowledge & information management
Superior challenges
COVID-19 // Pandemic aggravating factors
AI solutions and opportunities

Preparing for AI

- The learning curve will be fraught; the work-flow integration/implementation curve will be fraught; the maintenance curve will be never-ending;
- Discrete systems or tightly coupled?
- The ubiquity of tech teams
- The necessity of feedback loops and highly networked collaborations
- Planning will be lengthy and involve an unprecedented number of multi-disciplinary teams

#7: Medical Ethics Today Versus 50 Years Ago

- Honor patients' right to information and decisionmaking
- Practice honesty with patients
- Protect confidentiality
- Disclose errors
- Don't be intimidating, rude, disrespectful, offensive, or sexually provocative with patients
- Guard against personal bias
- Respect and honor teamwork
- Stay abreast with medical science and the contemporary standard of care



Implication: Professionalism is a Moving Target

- Professionalism is shaped by a host of factors:
  - Scientific knowledge
  - New technology and the ethical challenges that accompany their use
  - Economic resources of providers and consumers
  - Cultural and valuative diversity
  - Legal liability
  - Consumer expectations
  - Insurance trends

Ethical Practices

- We experiment with and create them
- Let's hope they're good
- If not, let's hope we have the freedom to change them

Thank you